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Corruption Risk Exposure of the Norwegian Government Pension Fund Global

An empirical approach to examine corruption risk of and its implications for the Government Pension Fund Global

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Master Thesis in Economics and Business Administration

NORWEGIAN SCHOOL OF ECONOMICS

Preface

"The issue [of corruption] is the most significant challenge, facing our generation."

- Sarah Chayes

(Author of "*On corruption in America"*, on the TRACE Podcast *Bribe, Swindle and Steal* in episode *Moneyland, Kleptopia and On corruption in America* from April 28, 2021*)*

We are deeply convinced that corruption has a harmful impact on progress in any society. Whether it is fighting global warming and social ills, facilitating economic development, or ensuring individual freedom – corruption poisons and slows all these efforts down. We are genuinely grateful for having been granted the opportunity to make a small contribution to corruption research and we hope that this thesis, demanding yet rewarding as it felt to us, can be put to use for a cause that we believe in.

This thesis is the final work of our master's program at the Norwegian School of Economics and was conducted in collaboration with TRACE International. On our resolute path to the version at hand, we haven't felt out of our depth more than one, maybe two[1] times. It's not least because of the support of the many people engaged with us that we found our footing through it all – and for that, we would like to thank them.

Firstly, our supervisor Tina Søreide, who supported us from our first sketches, did not lose faith and guided us to the final product. Shrey Nishchal, Kasper Vagle and Ivar Kolstad for their time, challenging discussions, and insightful comments. Francisco Santos, who gave valuable feedback on the finance aspects of our methodology. Wilhelm Mohn from Norges Bank, who provided great practical insights into responsible investment at the bank. Guro Slettemark, whose practical know-how of corruption and experience as a former member of the Council on Ethics were extremely helpful for understanding the practical work of the Council. TRACE International on two accounts; first, more literally, for their scholarship, but particularly the ideational guidance from Robert Clarke who was a tremendous support in finalizing this thesis.

To our partners, family, and friends: Thank you for your support, calming encouragement and critical discussions over the last six months. You've been a great backup.

NHH Norwegian School of Economics

Bergen, May 2021

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Abstract

In this thesis, we examine the bribery risk exposure of the Norwegian Government Pension Fund Global (GPFG) and analyze whether the pensions fund historically benefitted from being invested in companies with elevated bribery risk. Through a comparative study, we first contrast the bribery risk exposure of the countries in which the Oil Fund is invested with that of a peer group of three other sovereign wealth funds. Afterward, we examine whether the bribery risk of the investees' countries is an accurate indicator of the actual bribery risk of the firms. For this purpose, we develop an indicator, the Firm Bribery Risk Indicator (FBRI), which estimates corruption risk at the firm level by identifying red flags that signal risk of illicit behavior. The relation of this measure, approximating the actual bribery risk of a firm, to the country-level risk is analyzed. Finally, by applying a Fama-French five-factor model, we evaluate whether the fund historically benefited from being invested in companies that we previously identified to inhere an elevated bribery risk.

Our results show that the GPFG's relative number of equities and share of total assets invested in firms from high-risk countries exceeds those of its peers. However, we further find that the bribery risk of the country is an insufficient estimator of actual bribery risk. Thus, our findings suggest that a more detailed analysis of the bribery risk of the funds' investments is required to make a valid statement about the overall bribery exposure of each fund. Simply comparing the country-level bribery risk does not allow to derive meaningful insights but only grants a first, surficial impression.

Additionally, we examine the relation between country-level risk and the different risk determinants considered by the FBRI. We find that on average, firms listed in countries with high bribery risk scores are more often state-owned, have slightly less effective anti-corruption systems in place, and have subsidiaries in more risky countries. However, our findings do not suggest systematic differences in operating industries, political proximity, and the existence of previous bribery allegations of firms in respect to their country's bribery risk.

Our financial performance analysis revealed that the Oil Fund financially benefitted from being invested in firms with high corruption risk. However, we could not establish significant differences between the high- and low-risk portfolios' abnormal returns.

Keywords*: Government Pension Fund Global, corruption, bribery, red flags, TRACE Matrix, sovereign wealth funds, Fama-French multi-factor model, financial returns*

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Abbreviations

ABP	National Civil Pension Fund of the Netherlands
APFC	Alaska Permanent Fund Corporation
AUM	Assets Under Management
BPI	Bribe Payers Index (from Transparency International)
CoE	Council on Ethics
ESG	Environmental, social and governance
FBR	Foreign Bribery Report (from OECD)
FBRI	Firm Bribery Risk Indicator
GDP	Gross Domestic Product
GPFG	Government Pension Fund Global (Norway's oil fund)
IBRS	Industry Bribery Risk Score
IMF	International Monetary Fund
IPO	Initial Public Offering
LCRS	Listing country risk score
NAICS	North American Industry Classification System
NBIM	Norges Bank Investment Management
NPV	Net Present Value
NZ Super	New Zealand Superannuation Fund
OECD	Organization for Economic Co-operation and Development
OECD WGB	OECD Working Group on Bribery in International Business Transactions
OLS	Ordinary least squares
PEP	Politically exposed person
SIC	Standard Industrial Classification Code
SOE	State-owned enterprise
TCR	Transparency International's Transparency in Corporate Reporting
TI	Transparency International
TI-CPI	Transparency International Corruption Perception Index
WB	World Bank
WB-CoC	World Bank Control of Corruption

1 Introduction

1.1 Motivation

State-owned investment funds attracted growing attention in recent years as they gained relevance as solvent long-term share- and debtholders on the financial markets. Especially countries with large reserves of natural resources have become significant investors in the global economy, as spiking oil prices brought significant revenues to several sovereign wealth funds' (SWFs) home countries (Bahoo et al. 2020:1). Simultaneously, environmental, social, and governance (ESG) integration in investment practices ascended prioritization for SWFs as it did for the whole finance industry (Friede et al. 2015:211). SWFs are particularly stimulated to adequately account for ESG issues since their ultimate owners are the country's people. Therefore, the full scope of society's interests besides financial ones needs to be addressed by a pension fund. Societally harmful conduct of firms like corruption should not be fueled by SWFs allocating capital to such entities. That being said, contemporary views on SWFs are mixed. They received criticisms for their poor governance, lack of disclosure, and transparency (Shih 2009:330), as well as regarding their political influence (Kratsas & Truby 2015:97) and investment strategies (Kamiński 2017:734).

The Norwegian Government Pension Fund Global (GPFG) is the focal point of this thesis. With ownership of 1.4 percent of all the world's listed equities, Norway's Oil Fund is the largest sovereign wealth fund in the world and has significant economic power (The Economist 2017). Contrary to the abovementioned opinions, the GPFG is frequently considered the most transparent of all SWFs (Bahoo et al. 2020:1). Moreover, it consistently scored the highest in the SWF scoreboards developed by Bagnall and Truman (2013), which assesses the governance, accountability, and transparency of a total of 58 funds around the world.

Even though SWFs were scrutinized from several perspectives in recent years, little research was conducted addressing aspects of corruption in the funds. Some studies included corruption discussions in general assessments of SWF's governance performance (Aizenman & Glick 2009), while others focused on the relation of corruption level of the fund managing country and financial return (Zhang et al. 2018). However, to the best of our knowledge, a detailed analysis of corruption exposure in a SWF portfolio has not yet been conducted.

The obstructive consequences of corruption on society are widely recognized. Corruption hinders economic development and discourages foreign direct investment, distorts judicial systems, weakens competition, and subsidizes criminal activity (OECD 2011:3). The fact that

most funds operate highly diversified portfolios makes them vulnerable to corruption in numerous business sectors in different countries across several continents. The GPFG is no exception, as some of its equities have been recently associated with gross corruption scandals, involving the German multinational conglomerate ThyssenKrupp AG (in 2021) and the Brazilian oil and gas company Petrobras (in 2019). These cases attracted massive media coverage and directed attention to the responsible investment strategy of the GPFG. Therefore, we decided to examine the bribery risk of the whole portfolio in further detail. In this thesis, we evaluate whether the fund's eminent disclosure practices described by scholars are also reflected in its exposure to corruption.

1.2 Research objective

The main research question of this thesis is formulated as follows:

What is the extent of bribery risk in the GPFG's portfolio, and did the fund benefit historically from being invested in companies with high bribery risk?

For our research, the concept of bribery risk is crucial. When referring to bribery risk throughout this thesis, we distinguish three layers of risk that base on a concept described by Kenny and Søreide (2009:11): country-, industry-, and firm-level bribery risk. We define the country-level bribery risk as the risk arising from factors in respect to the legal and cultural environment, which affect all companies operating in a given country. Industry-level bribery risk is caused by determinants that are inherent in the business models of companies in a particular industry, such as requirements like operating licenses and other permissions. Firm-level determinants refer to red flags that are caused by the organization and management characteristics of a particular company.

1.2.1 Hypotheses

We address our overall research question by splitting it up into three hypotheses. Although textually connected, each one is analyzed separately throughout the thesis. Our first hypothesis is constructed in order to obtain an overview of the bribery risk exposure inherent in the GPFG's portfolio. Therefore, by focusing solely on the country level bribery risk, the fund is compared to a peer group of SWFs. To estimate country-level risk, we rely on the bribery risk scores provided by the TRACE Matrix.

***Hypothesis I**: The country-specific bribery risk exposure in the GPFG is not systematically different than of its peer sovereign wealth funds.*

The fact that a company is listed in a country where bribery risk is high, does not imply involvement in corruption. Companies from low-risk countries also operate in high-risk countries and vice versa. Moreover, previous research demonstrates that additional risk determinants besides bribery risk of operating countries affect the likelihood of a firm being involved in corruption. The question of what the country-level bribery risk can tell us about the actual bribery risk exposure of a firm is key for the interpretation of the analysis results under Hypothesis I. Thus, our second hypothesis aims to study the relationship between country-level bribery risk and the actual bribery risk of a company.

Hypothesis II*: Within the GPFG's portfolio, firms from countries with high bribery risk are subject to high bribery risk at the firm level.*

For testing this hypothesis, we estimate the firm-specific bribery risk with an indicator that comprises several risk determinants, the Firm Bribery Risk Indicator (FBRI). Moreover, the relationship between country-level bribery risk and particular risk determinants like political proximity or public ownership is examined.

The third hypothesis is formulated to evaluate whether firms with high bribery risk have positively contributed to the financial performance of the GPFG. Therefore, the abnormal returns of equities from the GPFG with high bribery risk exposure, indicated by a high FBRI score, are compared to those with modest bribery risk, indicated by a low FBRI score. We hypothesize that firms with high bribery risk have higher risk-adjusted returns.

Hypothesis III*: Within the GPFG's portfolio, equities with high FBRI scores have higher abnormal returns than equities with low FBRI scores.*

1.2.2 Scope and purpose

This thesis is written in collaboration with TRACE International, a non-profit organization based in the United States, that provides anti-bribery compliance support to multinational companies. The objective of this cooperation is to investigate to what extent the portfolio of the Norwegian Government Pension Fund Global (GPFG) is subject to corruption risk. The 2019 edition of the TRACE Bribery Risk Matrix (TRACE Matrix) is used as the primary source for the corruption risk analysis. By collecting and aggregating a wide range of recognized cross-country data on the perceived extent of corruption, combined with other measures for bureaucracy and transparency, it eases the study of bribery risk at the country level (TRACE 2019b:2). Consequently, our research focuses solely on bribery risk when investigating the extent of corruption risk exposure in the GPFG. Following the description of TRACE, we

define bribery risk exposure as the "possibility that bribe payments to government and other authorities' official(s) are paid to achieve an illicit competitive advantage" (TRACE 2019b:1).

The portfolio of the GPFG comprises equities, fixed income investments, and unlisted real estates. To limit the scope of our research and ensure comparability with other funds, this thesis considers only equity investments. Thus, the term "investment(s)" is used to describe equity investment(s).

With our thesis, we aim to contribute to both the existing literature of sovereign wealth funds and the field of corruption research. In the first part of our analysis, we assess and compare the corruption risk exposure across funds from different countries. Afterward, with the development of the FBRI, we propose a standardized approach for estimating the potential risk of bribery involvement for a firm. Finally, we evaluate the risk-adjusted returns of a subset of companies that we found to be at high exposure of bribery risk.

1.3 Structure

Having presented the background for our study, the next chapter considers the concept of SWFs in general and the responsible investment strategy of the GPFG in particular. Chapter 3 discusses the theory about corruption risk determinants at the country, industry, and firm levels. The identified indicators constitute the basis for our further analyses. Chapter 4 covers the empirical methodology of our study, the indicator we developed to estimate bribery exposure, and the statistical methods applied to evaluate our hypotheses. Chapter 5 describes the data collection, which is required for the empirical analysis elaborated in Chapter 6. The results are discussed in Chapter 7, while concluding remarks and suggestions for further research are outlined in Chapter 8.

2 Role and governance of the Government Pension Fund Global

2.1 Sovereign wealth funds

The term *sovereign wealth fund* was first used by Rozanov (2005:1) in his work "Who Holds the Wealth of Nations?" (Bahoo et al. 2020:1). Sovereign wealth funds (SWFs) are state-owned investment vehicles that invest internationally in various types of assets ranging from financial to real assets (Alhashel 2015:2). Based on the taxonomy of the International Monetary Fund, SWFs can be divided into five groups: (1) stabilization funds, (2) savings funds, (3) development funds, (4) reserve investment corporations, and (5) pension reserve funds (Al-Hassan et al. 2013:4). Since pension reserves are included to some degree in almost all SWFs, the terms SWF and pension fund are used interchangeably throughout this thesis. As of March 2021, 95 SWFs around the world are invested with a total of $8.07 trillion assets under management (AUM) (SWFI 2021). Thereof, the largest pension fund in terms of AUM is the Norwegian Government Pension Fund Global (GPFG), followed by China Investment Corporation and Hong Kong Monetary Authority Investment Portfolio.

2.2 The Government Pension Fund of Norway

Norway's Oil Fund was established by the Norwegian Parliament in 1990 with the purpose of investing the earnings produced by the petroleum industry. In a video published on the Norges Bank Investment Management (NBIM) website, Norway's previous prime minister, Jens Stoltenberg describes the primary purposes of the GPFG. Stoltenberg emphasizes that by pursuing a long-term savings plan, both current and future generations benefit from the oil wealth. In addition, he points out that the fund serves as a financial instrument for stabilizing the economy, equipping the Norwegian government with the ability to avoid overheating and inflation while providing tools to stimulate the economy in times of recession. The fund's governance model (exhibited in Figure 1) establishes a system for control and supervision.

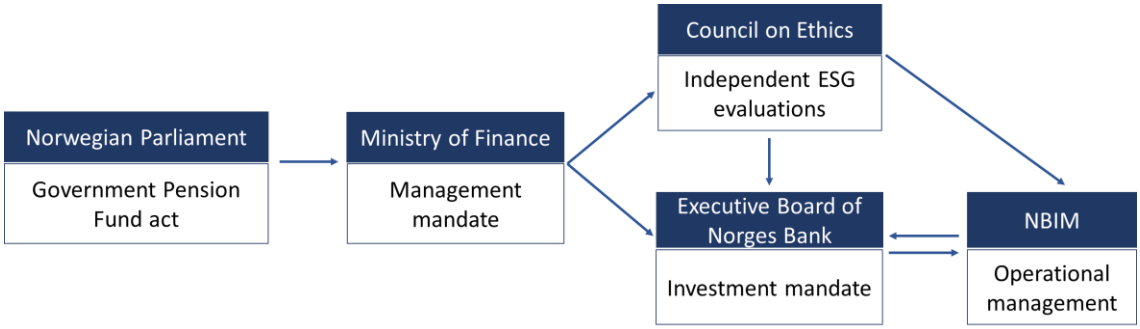

Figure 1: Governance model of the GPFG

As democratic representatives of the Norwegian people, the Norwegian Parliament and the Ministry of Finance are the principals of the GPFG. Norges Bank is responsible for managing the fund, and its Executive Board has delegated the operational management to NBIM, its internal portfolio management department. Furthermore, the Ministry of Finance set up the Council on Ethics (CoE) to perform independent ethical evaluations of the fund's investees. These assessments are based on ethical guidelines determined by the Norwegian Ministry of Finance (Norges Bank 2020a:25). The fund is the largest single owner in the world's stock markets and broadly invested across 73 countries, 12 business sectors, and 49 currencies. The GPFG's market value amounted to NOK10,914 billion by the end of 2020 of which 72.8% were equities, 24.7% fixed income investments, and 2.5% unlisted real estate (Norges Bank 2020a:6).

2.2.1 Responsible investment

The GPFG undertakes responsible investment mainly through two mechanisms: exercising ownership rights granted through the securities it controls[2] (1) and observation and exclusion of companies from its investment portfolio (2) (Halvorssen & Eldredge 2013:395). Active engagement is enacted by entering dialogues and discussions as well as demanding information beyond public disclosures. These mechanisms can be triggered by either product-based exclusion criteria, such as the production of tobacco or certain types of weapons, or conduct-based exclusion criteria, such as human rights violations and corruption (Council on Ethics 2019:9). Hence, ESG issues are integrated into risk management and may result in divestment of assets assessed to have an elevated, unmitigated long-term risk. As of the 3rd of March 2021, a total of 143 companies were excluded from the fund's portfolio. Most of the divestments were subject to the product-based coal criterion, while the fund merely divested from two companies[3] because of unmitigated gross corruption risk (Figure 2). Although in practice, Norges Bank might have withdrawn from investments due to gross corruption without publicly announcing it, the number appears relatively low, especially compared to divestments based on environmental concerns.

[2] These are subsumed by Norges Bank under "active ownership".
[3] JBS SA in 2018 and ZTE Corp in 2016.

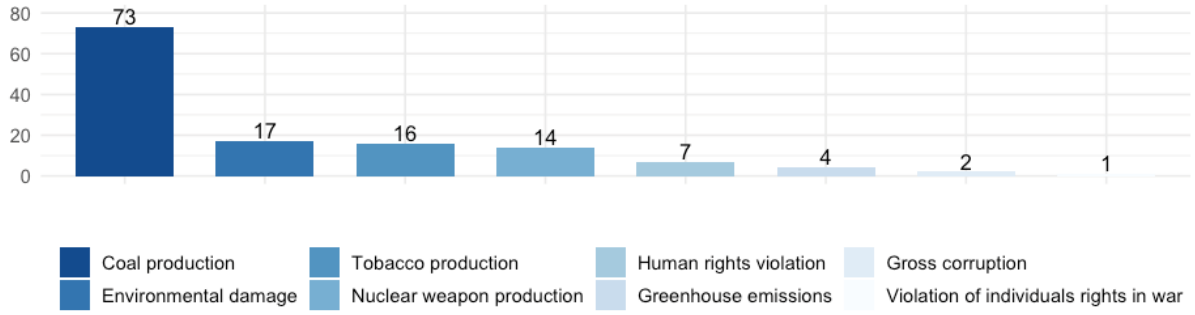

Figure 2: Excluded companies grouped by exclusion criteria

2.2.2 The Council on Ethics' work under the corruption criterion

Section 3 of the GPFG's ethical guidelines states that "Companies may be put under observation or be excluded if there is an unacceptable risk that the company contributes to or is responsible for gross corruption" (Ministry of Finance 2014:3). Corruption allegations against companies in the fund are systematized through portfolio monitoring. Provided there are many corruption cases in a specific industry, the CoE considers them collectively and investigates the most serious allegations. Such reviews were carried out on specific sets of companies from the oil service (2019), health care (2018), construction (2017), telecommunication (2016), and defense (2016) sectors.

When the Council uncovers a corruption case, several conditions must be met before a recommendation regarding either observation or exclusion can be sent to Norges Bank. Firstly, the CoE must be able to determine that the given company has been involved in gross corruption. Furthermore, it must assess the possibility that the firm may again be associated with corrupt acts in the future. Provided that both these criteria are met, the Council notifies Norges Bank about the detected ethical risk. Apart from exclusion and observation, the Executive Board of Norges Bank is equipped with a third tool to mitigate unethical behaviors, namely active ownership. This mechanism is utilized when the Board considers dialogue and exercising its shareholder rights to be the most suitable way for influencing ESG issues. A recent example is the case of the Chinese company PetroChina, whose senior executives were accused of accepting bribes in exchange for contracts to suppliers in multiple countries between the period 1980-2014 (Council on Ethics 2016:2). Since PetroChina has shown little cooperation with the CoE and failed to provide information about internal anti-corruption efforts, the Council has proposed divestment in December 2016 (Council on Ethics 2016:13). Norges Bank, however, refused to follow the recommendation and placed the company under

observation. However, a reiterated evaluation in August 2020 led to the decision to engage in PetroChina through active ownership (Norges Bank 2020c).

Norges Bank can deviate from the recommendations made by the CoE without justifying its decision to the Council. The PetroChina's bribery scandal illustrates that the escalation process of gross corruption cases in the fund is lengthy and lacks efficiency. The publication of the final decision is often brief and lacks explicit rationale. Therefore, the communication between Norges Bank and the Council appears one-sided (Knudsen 2020).

3 Corruption, bribery, and risk determinants

3.1 Differentiate corruption, bribery, and extortion

Several approaches have previously been undertaken to define corruption. From a legal perspective, definitions of corruption vastly alternate across jurisdictions, leading to inconsistent international anti-corruption endeavors (Astorga et al. 2012:5; Brown 2006:62). By law, corruption is not considered to be an illegal act unless defined as such. The principles for determining liability in corruption cases are defined by criminal law (Mungan 2012:53). It must be determined whether (1) a criminal act has occurred, which is described as active and passive bribery of public officials or between the private sectors. (2) Prosecutors must be able to identify the responsible individuals involved. Moreover, (3) proof must be secured that the crime was committed on purpose, meaning that the person responsible for bribery acted blameworthily. Lastly, criminal law requires (4) the absence of legitimate excuses. That being said, regulation of corporate liability also varies across countries, which further entangles the process to uncover and prosecute corruption offenses (OECD WGB 2015:11).

In economics and social science, practitioners like Transparency International and scholars frequently refer to corruption as the misuse of entrusted or public power for personal profit (Rose-Ackerman & Palifka 2016:9; Shleifer & Vishny 1993:2; Theobald 1990:2). Søreide and Rose-Ackerman accentuated the distortive mechanisms at play by describing corruption as "a trade in decisions that should not be for sale" (Søreide & Rose-Ackerman 2018:215). Corruption is an umbrella concept for several forms of misconduct like bribery, embezzlement, nepotism, or judicial fraud (Rose-Ackerman & Palifka 2016:9).

Consequently, bribery is one aspect of corruption among others. Rose-Ackerman and Palifka describe bribery as "the explicit exchange of money, gifts in kind, or favors [...] as payment for benefits that should [...] be allocated on terms other than willingness to pay" (2016:8). In the thesis at hand, the term bribery is used in a broad sense, including kickbacks and extortion. Kickbacks are bribes paid after the allocation of the service or good was realized (Morris 2011:10). In the case of extortion, all bargaining power lies at the side of the bribee, allowing to squeeze rents out of the eventually unintentional briber (Mikkelsen 2013:368). Under this definition, bribery is often considered the primary form of corruption (Brown 2006:62). Especially when focusing on corporate corruption, as is the subject of this thesis, bribery is often used interchangeably with corruption (Johnston 2005:20).

Since bribery is the predominant form of corruption, some corruption risk determinants can also be considered risk determinants for bribery. However, since all cases of bribery fall into corruption though not all corruption cases are bribery, corruption risk determinants are only considered when the respective determinant is logically relevant for explaining bribery risk. Because of the vast number of determinants, the following sections provide a structured overview of the most relevant determinants discussed in previous empirical and conceptual research papers, rather than constituting an exhaustive list.

3.2 Country-specific bribery risk

3.2.1 Country-specific risk determinants

Bribery risk determinants at the country level can be classified into (a lack of) *internal controls (1), external controls (2),* as well as *indirect determinants (3)* (Brunetti & Weder 2003:1803).

Internal controls comprise measures within a country's bureaucratic system, aiming to prevent and enforce corruption in its processes (Brunetti & Weder 2003:1803). One aspect in this regard is the mitigation of discretionary power allocated to single officials through supervision, for instance, through dual control principles and committee-based decision making. The expanded circle of involved parties raises detection risk and sets a higher threshold for corrupt collusion (Argandona 2001:166). Similarly, insufficient preventions against nepotistic hiring and promoting practices increase the bribery risk in public institutions, as close ties and dependencies among officials facilitate misconduct (Rauch & Evans 2000:66-68). Clear qualification criteria and standardized public announcements of vacancies can help to prevent nepotism (OECD 2020:94). Furthermore, substantial discrepancies between public and private sector wages can act as a booster for bribery. By help of a multiple equilibria model, Andvig and Moene (1990) show how such a difference can facilitate a long-term high corruption equilibrium. The authors argue that public officials converge to collude in bribery to counterbalance the payment gap to the private sector. Finally, a lack of transparency in the decision-making process of officials is a red flag for corruption risk at the country level, leading to lower internal prevention of corruption and impeding external enforcement of applicable law (Søreide 2014:48-49).

External controls refer to measures exercised by parties outside the bureaucratic system (Brunetti & Weder 2003:1803). A system of checks and balances and independent control institutions are fundamental for effective deterrence and enforcement of public corruption. Independent courts, as well as economic crime units and financial regulation institutions, are

required for raising the risk of detection and thus lowering the expected net gain of bribery. Establishing anti-corruption agencies is appropriate if the prevalent enforcement institutions like the police are at risk of being subverted by corruption. Respective competencies and responsibilities must be codified through rules or laws (Rose-Ackerman & Palifka 2016, pp. 391+411). Anti-corruption laws can be embedded in criminal or corporate law. Public procurement law entails fair and standardized contracting with private counterparties. In addition, anti-trust laws and authorities nurture competition and meritocracy, whose absence is a prerequisite for corruption (Søreide 2014:16). Yet, Billger and Goel (2009:303) show that the existence of corruption control policies does not significantly decrease corruption in a cross-country comparison, indicating that a plain installation of anti-corruption laws and institutions is not sufficient to fight corruption. Independence and impartiality of control institutions and the legal system must be ensured to make laws and control bodies work effectively (Andvig & Moene 1990:76; Søreide 2014:9-10).

Besides official authorities, NGOs and the free press are crucial external contributors to a country's successful anti-corruption endeavors (Billger & Goel 2009; Brunetti & Weder 2003; Treisman 2007). Their role is to monitor public officials and inform the general public about infringements of laws (Kalenborn & Lessmann 2013:858-59). Thus, NGOs and the media contribute to the accountability of democratically elected representatives by eradicating information asymmetries between the public as the principals and their elected agents (Rose-Ackerman & Palifka 2016:402).

Lastly, there are several *indirect drivers* mentioned in previous empirical research, whereof many are connected to a country's culture. For instance, empirical studies underpin that countries with prevailing Tribal and reformed Christian religions have a lower perceived corruption risk (Paldam 2001:411). Also, colonial heritage and education were identified as significant drivers of corruption (Escresa & Picci 2019:368; Serra 2006:229). Boateng et al. (2020) examined the impact of different cultural factors on perceived corruption in different countries. They found elevated levels of corruption where perceived and accepted hierarchies in society are substantial. Individualism and the average level of happiness negatively correlate with perceived corruption at a statistically significant level. Remarkably, they find that these three factors moderate the effect of good corporate governance leading to a lower level of corruption (Boateng et al. 2020:12-14).

Aside from cultural factors, economic development, usually measured as GDP per capita, is often associated with a negative relation to corruption, meaning that wealthier countries tend

to have lower corruption risk (Billger & Goel 2009:300; Treisman 2007:241). However, cause and correlation are hard to disentangle in this case due to multicollinearity of GDP per capita and perceived corruption on various factors, such as cultural determinants (Mauro 1995:702). Lastly, an opaque financial system facilitates corruption, since illicit payments need to be laundered through the financial system before they can be spent by the beneficiary. The easier it is to set up a broad network of shell companies to disguise illegitimate money transfers, the lower the encountered detection risk (Søreide 2014:13-14).

Empirical evidence about the strength of different drivers on corruption is difficult to establish. Reverse causality poses difficulties for a causal interpretation of findings, as most studies apply correlations or regressions. On one hand, a corrupt executive system could lead to ineffective institutions as corrupt decision-makers undermine the power of controls. On the other hand, weak institutions could increase opportunities for corrupt behavior due to the low risk of detection and punishment. Moreover, multicollinearity among the drivers, for instance between the free press and economic development measured as GDP per capita (Brunetti & Weder 2003:1822), hampers the identification of a specific driver's effect at the country level corruption risk.

3.2.2 Measurement of country-specific bribery risk

Measuring corruption and bribery is an arduous undertaking since it aims to capture hardly observable behavior. Due to its illegal nature, corruption usually remains concealed since involved parties seek to disguise their actions and hinder information flows to the public (Rose-Ackerman & Palifka 2016:14). Yet, researchers developed different approaches to capture corruption risk at the country level through *public opinion or expert surveys (1), composite indices (2),* and *empirical measures (3).*

Surveys of experts or the general public (1) aim to identify the prevalence of corruption in different countries by accessing subjective information about the perception of and the experience with corruption in a specific country. Hence, this type of measurement relies on the assumption that the true level of bribery is reflected by the people's personal experience with bribery. A well-known example is the Varieties of Democracy survey, which considers questionnaire responses from academics and practitioners (V-Dem Institute 2020). One benefit of surveys is the scalability of data access since they can be conducted in different countries, given an international network was established to carry out the interviews. Furthermore, experiences and perceptions can accumulate several manifestations and drivers of corruption, which might be hard to disentangle and measure separately (Sue & Ritter 2012:5).

The major downside of using surveys is the subjectivity of responses. The respondents' opinions can be biased by circumstances surrounding the conduction of the survey. As an illustration, the disclosure of a highly scrutinized corruption scandal can raise corruption perception, resulting in distorted survey responses (Tversky & Kahneman 1973:206-07). Finally, the number and characteristics of respondents across countries can vary and thereby introduce biases when comparing responses globally. These problems are underpinned by empirical studies showcasing how social background affects the perception of corruption (Maeda & Ziegfeld 2015:4).

Composite Indices (2) aim to mitigate some of the problems attached to questionnaires by considering multiple sources of qualitative and quantitative empirical data such as political stability or characteristics of the legal system (Mauro 1995:686). Included empirical data usually refers to some of the aforementioned corruption risk determinants. For instance, the TRACE Matrix uses indices from the Bertelsmann Foundation to approximate freedom of speech (TRACE 2019b:4). The different data points across sources are normalized and aggregated for each country. The final score of a country is often transformed into a corruption ranking (Lambsdorff 2007:2). An advantage of composite indices is the utilization of large number of data points and sources, limiting the effect of idiosyncratic biases within a survey while mitigating differences in data availability across countries. Moreover, the usage of variables besides the perception of corruption allows to account for more objective determinants of corruption risk but might be neglected by subjective cognitions. However, there are drawbacks. A composite index's outcomes can still be influenced by its previous results, as expert surveys often account for most of the included sources. Also, normalization and aggregation of different data sources with different dimensions can lead to loss of information and accuracy, which leads to large confidence intervals of estimates. Finally, many indices revise their methodology and refine the underlying data sources over the years, making time comparisons potentially misleading (Chabova 2017:1880). Therefore, we refrain from time-series analyses for determining corruption risk in the Norwegian GPFG.

With the rise of available public data, many scholars attempted to objectivize corruption measures by creating *empirical indices* (3) based on empirically measurable proxy variables (Denly 2020; Escresa & Picci 2017; Golden & Picci 2005; Picci 2018). Golden and Picci (2005) propose an index that compares the realized physical construction projects with public construction expenses across different regions in Italy. They assume higher corruption in regions where the ratio of money spent on physical infrastructure compared to realized

infrastructure is large. Another index, developed by Escresa and Picci (2017), approximates the level of corruption in a country by comparing the share of enforced cross-border bribery cases involving foreign public officials to the export volume from briber to bribee economy. A higher ratio indicates a higher bribery risk of the briber country. These indices benefit from using non-perception-based data, which eliminates unconscious irrationalities and endogeneity of composite index results. On the flip side, the chosen proxy variables might not provide meaningful global comparisons and their application is limited due to a lack of data for some countries.

3.3 Industry-specific bribery risk

3.3.1 Industry-specific risk determinants

Every industry has idiosyncratic characteristics that companies need to address through their business models. Some industries' characteristics provide a nourishing soil for bribery, leading to a systematically higher bribery exposure of companies in respective industries.

The OECD Foreign Bribery Report (2014) revealed that 57% of enforced international bribery cases between 1999 and 2014 were conducted to obtain public procurement contracts. Although enforcement data in itself does not reflect bribery risk, firms from industries like construction, defense, and human health, in which companies *operate as suppliers of the public,* have been frequently involved in bribery cases. This is supported by analytical argumentation: incentives for firms to pay bribes to secure procurement contracts are salient since the potential net present value (NPV) of these contracts can be large (Rose-Ackerman & Palifka 2016:96). A rent-seeking counterparty in the deal with discretionary power over the procurement decision is well-positioned to negotiate a share of the company's NPV for personal gain (Li, S. 2019:6; Søreide 2002:4-5). Moreover, bribery risk intensifies in sectors where the *average contract volume is high*, since any single contract is of high value (or NPV) for the supplier and hence, incentives to conduct illicit payments in exchange for an unfair competitive advantage amplify (Davis, J. 2004:58).

Other common sources for public officials to retrieve bribes are *concessions and operating licenses,* granting firms the right to use or extract public resources like land, mines, highways, or oil fields. Søreide and Rose-Ackerman (2018:198-200) delineate that collusive deals are most harmful to society when the allocating resource is scarce and the allocation process qualification steered. Concessions and licenses fulfill both aspects. The underlying assets, such

as oil fields, are scarce and the company which qualifies best during the tender process should receive the grant (Rose-Ackerman & Palifka 2016:110).

Moreover, *highly regulated* industries allow for more discretionary power of officials charged with regulating and controlling companies operating in these sectors. This includes monopolistic or oligopolistic industries like utilities or oil and gas, where government intervention is a common act to balance welfare distribution between supplier(s) and customers (OECD WGB 2015:10). Scholars claim that in these industries bribery is frequently used as a lever to influence decision-makers to reallocate welfare from the customers' side to the supplier's side in exchange for private gain of the official (Søreide 2002:5-6). This can be accomplished by aiming either at diminishing costs, like taxes and fees or on enhancing revenues (Rose-Ackerman & Palifka 2016:51).

Finally, the *number of interactions* with authorities and public officials can systematically vary across industries. For instance, the transportation and real estate industry depends on the customs clearance and property or land registry process, respectively (Søreide 2014:9-10). Where companies' business models depend on the efficiency of public processes, bribe payments can become crucial contributors to a firm's competitiveness by reducing lead times and enhancing process efficiency. This lifts the bribee's bargaining power to demand illicit payments and the briber's willingness to pay, especially in countries where public processes are cumbersome and lengthy (Cuervo-Cazurra 2016:40).

3.3.2 Measurement of industry-specific bribery risk

Although various scholars examined the risks and prevalence of bribery within specific industries (OECD WGB 2015; Feinstein et al. 2011; Kenny & Søreide 2009), few comparative empirical analyses of corruption across industries have previously been developed. This is mainly because of two reasons. First, the realization of industry-specific risk factors is linked to country-specific risk factors. Exemplarily, corruption risk in industries requiring concessions is linked to a country's legal requirements and anti-corruption regulations for tender processes (Kenny & Søreide 2009:14). Second, there is no responsible addressee for systematic shortcomings in an industry. Country indices aim to showcase shortcomings in specific jurisdictions to facilitate improvement of the legal and institutional framework (Søreide 2006:2). Unlike in the case of countries, no ultimately responsible addressee exists for particular industries.

One well-known empirical approach to compare corruption across industries is TI`s Bribe Payers Index (BPI) from 2011. The survey examines perceptions on bribery of 3,000 business executives from 28 countries. The respondents are asked to assess the likelihood of a company from a particular industry to pay a bribe on a scale from 0 to 10, where 10 means that a company never pays a bribe (Transparency International 2011:4). The assessments range narrowly from 5.3 points (construction) to 7.1 (agriculture), though still indicate significant differences across sectors. For instance, the 95% confidence interval of *Power Generation* (Rank 13), ranging from 6.1 to 6.6, is strictly below the one of *Consumer Services* (Rank 7) with a confidence interval from 6.7 to 6.9 (Transparency International 2011:15).

The World Bank Enterprise Survey covers information on a vast range of company information from 169,000 firms in 146 countries. Besides financial and organizational indicators, the survey collects information on a broad range of compliance topics, including bribe and facilitation payments transferred to public officials (World Bank 2020). Although the survey only contains information on bribery at the firm level, its global setup and the inclusion of companies from all industries make it a promising source to examine bribery risk across industries. However, until this thesis was finalized, no reports have been published analyzing the data for this purpose. We tried to conduct a similar analysis by ourselves but were restricted by the lack of granularity regarding the information on industries contained in the survey.[4]

The OECD *Foreign Bribery Report* (2014) and ACFE's *Report to the Nations* (2020) present two approaches to analyze previous investigation cases. While ACFE considers embezzlement, bribery, money laundering, and other corruption cases experienced by ACFE members (ACFE 2020:6-7), the OECD report solely examines officially enforced cross-country bribery cases (OECD 2014:7). Judicial statistics of corruption cases have little reliability, as a corrupt legal and political system impedes efficient corruption enforcement. Considering cross-country enforcement cases avoids biases resulting from conflicts of interests, as the enforcing country is different from the one potentially involved in the crime (Escresa & Picci 2017:197). This is relevant for industry-specific risks, as countries with high corruption levels tend to have increased exposure to the extraction industry, also known as the resource curse (Davis, G. & Tilton 2005:233). Consequently, cross-country enforcement can be assumed to portray a less biased picture of bribery across industries, which is why we used the OECD Foreign Bribery Report together with the BPI for estimating bribery risk differences across industries.

[4] Our attempt to utilize this data is explained in more detail under section 4.2.2.

3.4 Firm-specific bribery risk

3.4.1 Firm-specific risk determinants

Besides risk factors related to countries and industries where a company operates, certain organizational and managerial firm-level characteristics also impact the vulnerability to bribery. Research shows that these factors include customer base composition (Cosenz & Noto 2014:243), perceived financial constraints (Martin et al. 2007:1416), ownership structure (Clarke & Xu 2004:5), the proximity to politics (Kenny & Søreide 2009:11), corporate anti-corruption endeavors (Transparency International 2014:32-33), third party usage (Drugov et al. 2013), and previous involvement in bribery cases (Ryder & Pasculli 2020).

A firm's *customer base composition* is the ratio between public and private clients. Firms involved in public procurement may utilize bribery as a marketing vehicle to establish relationships and boost sales. Simultaneously, public procurement officials might exploit their discretionary power to request illicit money transfers. In this situation, both parties can benefit from an illegal sale of the decision, leading to a platform for collusive bribery (Cosenz & Noto 2014:243).

Martin et al. (2007:1414) argue that monetary restrictions such as collateral obligations, unfavorable interest rates, local banks' lack of resources, and internal budget constraints increase the firm's probability of supplying bribes to public officials. These factors can be generally described as *perceived financial constraints*. Although the argument that bribes are used when financial constraints hamper organic growth is plausible, it is challenging to establish empirical proof for this claim. Since at the macro level several other factors with a presumably causal effect on bribery, like political stability and GDP per income, correlate with interest rates, it is difficult to distinguish correlation and causation in this case (Cebula 2011:65).

Clark and Xu (2004) argue that ownership structure matters for bribery risk since beneficiaries of state-owned enterprises (SOEs) are often unclear and cannot exercise controlling and monitoring rights directly. In this case, the ultimate beneficiaries of the investment can be, among others, the government treasury, pensioners, or general citizens. Unlike private blockholders, these groups can monitor the executive board only through proxies with confined personal interest, potentially putting less pressure on management to reduce corruption under public ownership. In addition, principal-agent problems are more severe in public enterprises, as salaries might be tied to public labor agreements, making payments of performance-based

bonuses and stock options difficult (Clarke & Xu 2004:5). State ownership further implies closer personal connections to politics and the public that might facilitate bribe payments (Kenny & Søreide 2009:6). Although descriptive approaches draw a clear picture of state ownership adversely affecting corruption, empirical research studies found both negative and positive effects of state ownership on corruption (Billon & Gillanders 2016:1076). Arikan (2008:724-25) sheds light on this puzzle by finding that privatization limits corruption only if ties of politics to the company management are properly unraveled. However, the author claims that this would often not be the case in transition countries where perceived corruption is high. Thus, samples that include mainly respective countries reveal a nonsignificant or even adverse empirical effect of privatization on corruption.

As bribery requires trust among the involved parties, *proximity to politics* can signal elevated risk. These connections can be established via lobbying efforts (Kenny & Søreide 2009:11). Both bribery and lobbying are viewed as a means to influence the regulatory environment, but the distinction between these two practices is often vague. Harstad and Svensson (2011:46) refer to lobbying as an activity that aims to change existing rules or policies, whereas bribing is described as an attempt to get around these regulations. Furthermore, ties to the government may root in personal connections, like politically exposed persons (PEPs)[5] among the management or shareholders of a firm (Choo 2008:374).

Internal *anti-corruption practices* also influence bribery risk at the firm level. Empirical studies show that compliance programs are an efficient lever to prevent and fight corruption within the corporation (McKinney et al. 2010:512). The presence of a whistleblower policy, a comprehensive code of business ethics and suppliers' conduct, and well-designed anti-corruption regulations can support and promote good behavior (Bussmann et al. 2017:258). Although existing compliance programs without proper implementation in the organization are little effective in preventing bribery (McKinney et al. 2010:513), public reporting on the key elements of anti-corruption programs like whistleblower protections signal an awareness of the topic and stresses the accountability of an organization and its employees for misconduct (Transparency International 2014:32-33).

The involvement of agents and other *third parties* such as consulting or law firms is a frequently used scheme in historic foreign country bribery cases, such as the BAE Systems (TRACE 2014) and Daimler cases (TRACE 2016) showcased previously. Intermediaries support the exchange

[5] Although there is no commonly agreed definition of PEPs, they are frequently referred to as natural persons with current or previous political functions or such individuals' close family members and associates (Choo, 2007:372).

between buyers and sellers by utilizing knowledge in sellers' goods and buyers' needs, hence lowering bargaining costs, while building a reputation for credibility (Drugov et al. 2013:79). Consequently, middlemen are often utilized because they remove uncertainty regarding whom and how much to bribe, and thus reduce the risk of detection for both the briber and the bribee (Hasker & Okten 2008:104). Additionally, detection of bribery initiated by an agent may find the agent guilty, while the involved parties may keep their anonymity. If exposed, firms can deny responsibility by arguing that the intermediary bribed on its own initiative. Moreover, Drugov (2013:79) shows that intermediaries facilitate corruption by reducing the moral costs of the companies and public officials possibly involved in bribery.

The presence of *previous bribery allegations* can signal inadequate bribery prevention systems and deficiencies in the firms' anti-corruption practices. Using a dataset describing the business activities of 530 Swiss firms, Ryder and Pasculli (2020: Chapter 14) show that the likelihood of facing bribe requests is higher for firms with previous involvement. The authors specify that more than half of the firms in the study that were requested for illicit payments have been asked more than once. However, corruption enforcement actions can also improve internal control systems and compliance practices in the long run. Siemens is an interesting example. After having used a variety of methods to make illegal payments to government officials between 2001 and 2007, totaling approximately $1.4 billion (TRACE 2020a). Following the scandal, Siemens introduced strict rules and anti-corruption processes, hired numerous compliance officers, and established an external ombudsman. Moreover, in an attempt to change its internal culture, it launched a comprehensive training and education program on anti-corruption practices for its employees (Löscher 2012).

3.4.2 Measurement of firm-specific bribery risk

To the best of our knowledge, when this thesis was finalized in May 2021, a comprehensive indicator that measures firm-level bribery risk had not yet been constructed. However, some scholars have developed analytical approaches for firm-level analyses of corruption, which will be outlined in this section alongside the benefits and shortcomings.

The most simplistic method is to directly apply country-level or regional data of corruption as an indicator for firm-level corruption (Athanasouli & Goujard 2015:1017). The shortcomings of this approach are obvious. It implicitly assumes that for a sufficiently large sample, firm and industry-specific factors cancel each other out, and the aggregated corruption level converges towards the country- or region-level corruption risk. This assumption only makes sense for research designs where regions or countries shall be compared by analyzing firms that are later

aggregated on a regional level. Athanasouli and Goujard (2015), for instance, applied regional corruption data to examine the effects of management practices on corruption in companies from different regions in central and eastern Europe. However, to measure and compare bribery risk at the firm level, this method is insufficient.

More reliable measures of bribery at the firm level are enterprise surveys. Asking respondents to what degree bribery occurs in their company is frequently used to measure corruption on the supply side of bribery (De Rosa et al. 2010:3). Examples are the Uganda Industrial Enterprise Survey (Reinikka & Collier 2001:207), the World Bank Enterprise Survey (World Bank 2020), and the Business Environment and Enterprise Performance Survey (BEEPS), where respondents were asked to determine how often bribe payments were part of a transaction (De Rosa et al. 2010:11). Fisman and Svensson (2007) applied the Uganda survey results as an indicator for the firm-level bribery risk to analyze how bribery affects firm growth. However, the accuracy of survey responses is influenced by the trust in the party conducting the survey. Questions from a research organization that aims to analyze the risk of bribery within a specific industry or region might be answered more freely than for investors reaching out to evaluate potential targets (Reinikka & Collier 2001:467). The major setback of enterprise survey data is that it cannot be applied to any company. To use such data to derive conclusions about the bribery risk of firms in the GPFG portfolio, one would be constrained by the fact that a particular company would have participated in an enterprise survey. However, since the names of companies are usually encrypted, enterprise surveys do not constitute an appropriate source for measuring bribery risk in the GPFG.

This problem is addressed by another approach that analyses firms' anti-corruption efforts in public reports. Since transparency acts as the converse of corruption, company data about transparency may be used to approximate the firm-level risk of a company being involved in bribery. These approaches hinge on the assumptions that firms report less about corruption compliance topics where they lack adequate internal controls and therefore face a higher risk (Lopatta et al. 2017:51-52). TI suggests a systematic approach that analyzes public disclosures of companies regarding 26 factors categorized in companies' anti-corruption programs and internal controls (1), organizational transparency of subsidiaries (2), and country-by-country reporting of key financial and non-financial performance indicators (3) (Transparency International 2014:32-33). Lopatta et al. (2017) follow a similar methodology. The authors create a list of around 200 nouns, adjectives, and verbs related to corruption and count how often these terms are mentioned in the audited annual reports of each firm. The firms are then

sorted into quintiles, where the quintile with the lowest number of respective terms in the report is considered the quintile with the highest risk of corruption (Lopatta et al. 2017:52).

Both approaches validly imply that transparency generally mitigates corruption, which requires hidden agreements, opaque transfers, and disguising accounting practices (Halter et al. 2009:375). Moreover, the external communication of anti-corruption endeavors, like whistleblower programs and the refused reprisal of whistleblowers, gives employees more certainty when speaking up and allows them to accuse companies of deviating from reported compliance principles (Luz & Spagnolo 2017:734). On the downside, only evaluating what a company communicates about corruption efforts without looking at actually implemented procedures leaves this approach vulnerable to window-dressing, which describes the presentation of rules, guidelines, and processes that are not followed up and lived by the organization (Lindstedt & Naurin 2010:301). Especially for the approach of Lopatta et al. (2017), it remains questionable whether the inflated usage of corruption-related words in the annual report indeed signals higher transparency and compliance. Higher coverage of pertinent terms might be triggered by events like external investigations, forcing a company to consider these topics in their annual report, rather than proactive transparency aspirations.

3.5 Overview

Previous literature describes several determinants of bribery risk on different levels. They are attributable to the jurisdiction and culture (country-level), the business model shaped by the industry (industry-level) as well as different organizational and managerial factors (firm-level). These factors are summarized in Figure 3. Measurement of corruption is mainly developed at the country level, where several profound indices exist, aiming to estimate what is intentionally hidden. As Figure 3 depicts, moving to industry-specific measures of bribery risk, similar comprehensive composite indices do not exist. Even fewer approaches have been developed to measure firm-specific corruption and bribery risk. Therefore, empirical data from the Bribe Payers Index (2011) and the OECD Foreign Bribery Report (2014) are aggregated to create an indicator that ranks industries based on their inherent bribery risk. To quantify the bribery risk of particular firms, a completely new indicator, the FBRI, is created.

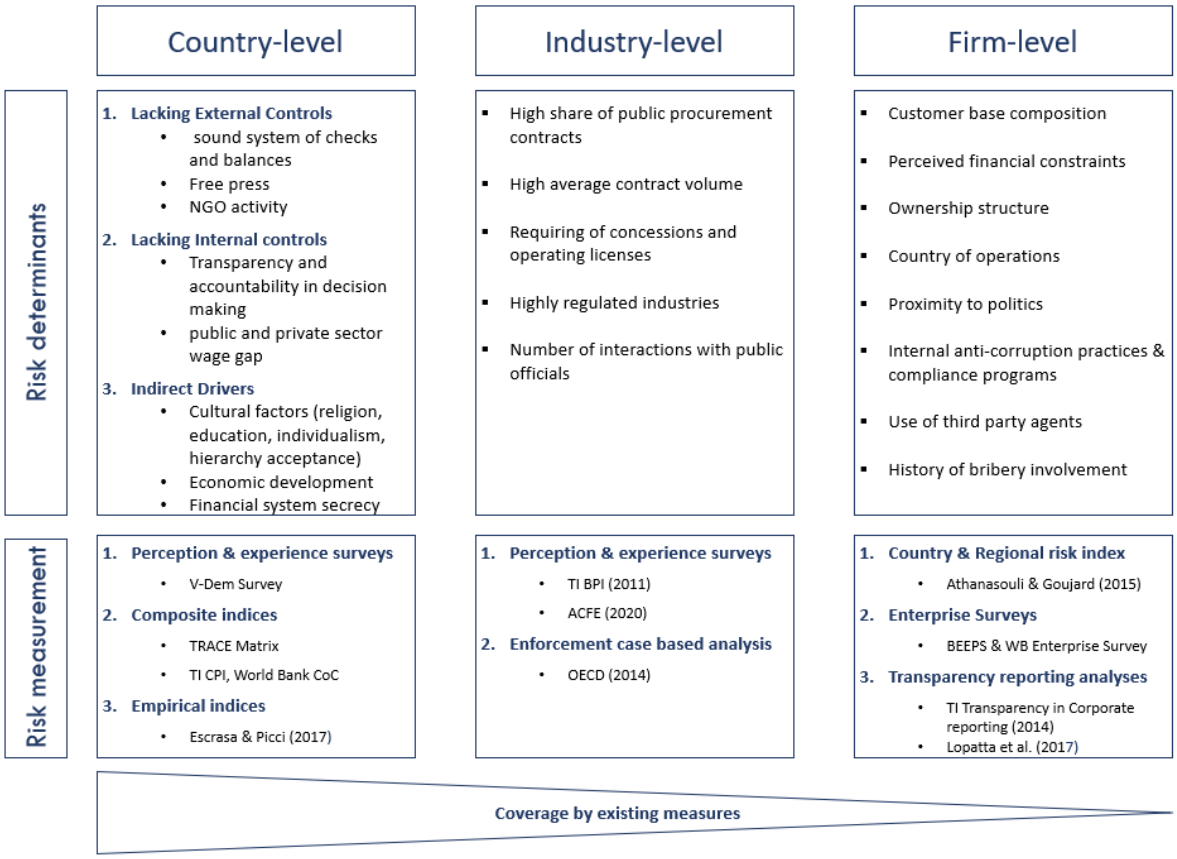

Figure 3: Overview bribery risk determinants and measurement

4 Empirical methodology

The purpose of this study is to examine the bribery risk in the Norwegian GPFG, which is pursued in a twofold analysis. In an initial step, a comparative approach is presented, which includes all portfolio companies but solely considers the country-level risk of the investments. Secondly, utilizing a sample drawn from the GPFG portfolio, the firm-specific bribery risk is analyzed by developing an indicator, the FBRI, to identify red flags that signal increased potential of a company to pay bribes in its course of business. By doing so, we contribute to existing research by proposing a data-driven indicator of bribery risk at the firm level. This indicator is used to study the relationship between country-level bribery risk and the firm-specific bribery risk from the bribe payer's side.

4.1 Country-level bribery risk comparison

For an initial overview of the bribery risk exposure of the GPFG, the fund's portfolio is compared to a selected peer group of sovereign wealth funds. The comparison is carried out by considering the bribery risk of the investment's primary listing countries. Consequently, the analysis merely examines the inherent country-specific bribery risk of the holdings and disregards their industry- and firm-specific bribery risks. This simplification is required given two reasons. Firstly, information regarding the investments' business sectors is not available for all funds. Furthermore, the sheer number of firms included in the portfolios makes the collection of firm-specific risk indicators unfeasible. The TRACE Matrix's overall country risk score is used as an estimation for assigning a bribery score to each holding.

4.1.1 Peer selection of sovereign wealth funds

To investigate the country-specific bribery risk of the GPFG, we construct a benchmark set of sovereign wealth funds. This set comprises the New Zealand Superannuation Fund (NZ Super), the Alaska Permanent Fund Corporation (APFC), and the Dutch Algemeen Burgerlijk Pensioenfonds (ABP). The rationale for selecting funds for benchmarking is threefold. Firstly, in parallel with the portfolio of the GPFG, the investments of the chosen wealth funds are required to be highly diversified across multiple industries in a wide range of countries. Table 1 shows that all funds are well diversified and invested across 50 or more nations. Thereby, potential biases due to the size of the fund, measured by assets under management, are mitigated. Furthermore, the country-specific corruption risk of the countries owning the wealth funds has to be comparative to the one of Norway. This is approximated with the TRACE Matrix Scores. SWFs frequently invest a large share of their AUM in the domestic economy

as a capital stimulus for domestic firms. Thus, comparing the GPFG to SWFs from high bribery risk countries could lead to biased results because of the higher share of investments in domestic countries. Therefore, we only include funds with comparable domestic country bribery risk in the analysis of this thesis. Lastly, the selection process is influenced by the provision of exhaustive, publicly available data on the pension funds' portfolios, including the market values of all firms. The chosen peer funds suffice in all aspects mentioned above as shown in Table 1.

Table 1: Sovereign wealth funds in the empirical study

	GPFG	NZ Super	ABP	APFC
Countries in portfolio	73	50	56	70
Number of equities	9,202	6,541	3,539	11,545
AUM (USD)	814 billion	13 billion	210 billion	19 billion
TRACE bribery risk score	5	8	11	20
TRACE risk category	Very low	Very low	Very low	Very low
Description	Norway's oil fund, the Government Pension Fund Global was created after the oil discovery in the North Sea. The first amount was deposited in the fund in 1996.	The New Zealand Superannuation Fund is the sovereign wealth fund of New Zealand. The fund began investing after it received an initial contribution of $2.4 billion from the government of New Zealand in September 2003.	The pension fund for employers and employees of government and educational institutions in the Netherlands. Its predecessor, the Dutch Civil Servants Pension Fund was established in 1922 following the adoption of the superannuation act.	The Alaska Permanent Fund Corporation was created by the Alaska Legislature in 1980 as a quasi-independent state entity tasked with the mission of investing and managing the assets of the Alaska Permanent Fund.

Beyond the selected peer funds, we accessed information regarding two additional portfolios: the Investment Corporation of Dubai and the Mubadala Investment Company. Both funds are owned and operated by the government of the United Arab Emirates. Their equity portfolio, however, is less diversified than the GPFG, with only less than one hundred equities per fund. In addition, the United Arab Emirates' bribery score of 33 is clearly above Norway's country

risk and hence does not fall into the *very low* TRACE risk category[6]. Based on these differences, these funds are not considered comparable to the GPFG and therefore not included in the peer group.

4.1.2 Estimating the country-level bribery risk

The country-level bribery risk of each equity investment is determined by the TRACE Bribery Risk Matrix (TRACE Matrix) score of the investee's primary listing country. Some of the well-known composite indices include the Transparency International's Corruption Perception Index (CPI), World Banks's Control of Corruption (CoC), and the TRACE Matrix. The TRACE Matrix does not only utilize the largest number of sources among the three; it also provides disaggregated scores for 194 countries in four different dimensions.[7] This allows for a more granular analysis of bribery risk. Despite the drawbacks of composite indices, the TRACE Matrix's transparency regarding its data collection and aggregation, along with the wide range of countries included in the index, makes it a suitable tool for empirical analysis.

For reflecting country level bribery risk the primary listing country is preferred over the incorporation country since incorporation is often conducted in tax-favorable jurisdictions without any operational relevance to a company's business. On the contrary, the primary listing country is usually selected for strategic reasons, as it provides direct access to equity investors in the respective country. IPO signaling theory claims that high-quality firms signal quality by choosing stock markets where listing requirements are strict (Wong et al. 2014:565).The share of equities for which incorporation and listing country deviate account for less than 8% of the GPFG portfolio investments. Hence, the listing and incorporation country equal for the clear majority of firms in the GPFG, but for firms where listing and incorporation country deviate, the listing country is assumed to be a better proxy for a company's main operations country. As an example for the consequent score assignment, the Brazilian company Petrobas, primarily listed at the B3 exchange in São Paolo, is assigned a bribery risk score of 47, the TRACE Matrix total risk score of Brazil.

In addition to the TRACE Matrix, the World Bank's Control of Corruption (WB-CoC) and Transparency International's Corruption Perception Index (TI-CPI) are applied to run a robustness check to verify the previous results. Since the scores of the WB-CoC range between

[6] An overview of the bribery risk categories *very low*, *low*, *moderate*, *high*, and *very high* of the TRACE Matrix, including the threshold scores, is provided in Appendix A. Whenever we refer to the risk categories defined by TRACE, italic font is used for the category names.
[7] More detailed information on the TRACE Matrix is provided in section 5.1.2.

-3 and 3, they are normalized on a range between 0 and 100. Using this transformation makes the results directly comparable with each other.

4.2 Firm-level bribery risk analysis

To examine the relationship between listing country bribery risk and firm bribery risk, an indicator for the latter is established as current literature does not provide a comprehensive measure. This section outlines the creation of the Firm Bribery Risk Indicator (FBRI). Subsequently, we describe the input variables that measure different bribery risk determinants and their accumulation, including the weighting of variables to determine the final FBRI score.

4.2.1 The Firm Bribery Risk Indicator

The FBRI is designed to identify red flags at the company level, which signal an elevated potential for bribery involvement. It is developed as a potential tool for practitioners and other scholars in both, portfolio compliance controls and empirical studies at the firm level.

The FBRI scores range between 0 and 100, with higher values indicating higher bribery risk. It is an interval-scaled measure. This means that the same interval indicates the same incline in bribery risk potential for the full range of possible values. An FBRI score of 40 signals higher risk than a score of 20, though it does not imply that the former is twice as risky as the latter, a property that only occurs for ratio scaled measurement. This is due to the lack of an absolute zero point. An FBRI score of zero cannot entail that the respective company is not engaged in bribery with certainty.

The selection of variables, serving as the inputs for calculating the FBRI score, is derived from bribery risk determinants and measurements presented in the literature review. All three levels of bribery risk (country-, industry-, and firm-specific) are addressed by the indicator (see Table 2).

Table 2: Conceptual overview of FBRI variables

No.	Risk Level	Risk Factor	Measurement	Variable
1	Country-Level	Bribery risk in operating countries	TRACE overall bribery risk score of subsidiaries' incorporation countries	Operating Countries
2	Industry-level	Bribery risk in operating industries	Industry bribery index based on TI BPI and OECD FBR for subsidiaries' operating industries	Subsidiary Industries
3	Firm-Level	Management quality & anti-corruption efforts	Anti-corruption efforts in public reports based on the TI TCR Report	Bribery Prevention
4	Firm-Level	Public ownership	Direct and indirect ownership of states and governments	Ownership Structure
5	Firm-Level	History of bribery involvement	Number of previous allegations against a firm for involvement in bribery cases	Previous Allegations
6	Firm-Level	Proximity to politics	Number of PEPs at the board level	Political Exposure

The variables are selected to capture the most relevant determinants that impact the bribery risk of the company (compare Figure 3, p. 17). At the country level, the TRACE Matrix accumulates several data points regarding the external and internal controls for bribery in a country, as well as cultural factors. The interplay between risk determinants at the firm and industry level is fluent. Risk factors shaping an industry always apply to all firms operating in that particular industry. Thus, it is crucial to reflect which measures can vary strongly across companies even when operating within the same industry and are consequently worth the time being investigated individually at the firm level. Risk determinants that are similar for companies operating in the same industry are consequently not investigated separately at the firm level but are assumed to be indirectly covered by the industry-level risk measure. For example, the risk determinant *Customer Base Composition* (compare Figure 3, p. 17), which indicates the share of public authorities and institutions among a company's customers, is assumed to be systematically different across industries. Defense and construction companies will have more public clients among their customers than grocery wholesalers. Thus, these risk determinants are considered through the bribery risk of the industry although they could be theoretically measured at the firm level.

Having outlined this, certain risk determinants are not represented in the FBRI due to a lack of accurate data or an excessively time-consuming data collection process. For instance, information regarding the quantity and quality of third-party usage is usually kept concealed.

Hence, the prevalence of third parties in a company's operations and its inherent bribery risk is not included in the indicator.

The following paragraphs delineate the six chosen variables, demonstrate the assignment of scores, and discuss the weighting of variables in the aggregation to create the FBRI score.

4.2.1.1 Operating Countries and Subsidiary Industries

The legal, political, and cultural environment in countries, where business contracts are negotiated and interactions with public authorities exist, is relevant for the bribery exposure of a company (Søreide 2014:5). Consequently, only looking at the headquarter or listing country is not exhaustive when determining a firm's bribery risk resulting from its legal and cultural environment of operations. Previous cases have shown that corporations headquartered in low-risk countries benefit by illicitly securing public contracts in highly corrupt countries (Pollack & Allern 2018:73). Two examples are the cases of Telia (Finland and Sweden) as well as Telenor's (Norway) joint venture Vimpelcom, both bribing Uzbek president's daughter Gulnara Karimova to gain operating contracts for several years starting in 2012 (Pollack & Allern 2018:74).

Companies usually keep their exact customers and operating countries concealed. Consequently, the subsidiaries' incorporation countries are used to approximate operating countries, since legal presence in a jurisdiction requires the company to become integrated into the local legal system. This occurs through channeling funds in the country, hiring employees, and establishing contacts with other local businesses on the demand or supply side. Again, the TRACE overall bribery risk score is applied to measure each subsidiary's country bribery risk. As the FBRI is designed to capture bribery red flags, the score of the variable *Operating Countries* is calculated based on the average score of the three countries with the highest bribery risk. Thus, only the upwards outlier countries are considered. Applying a simple average across all subsidiary risk scores is rejected, as a multinational corporation can be at high risk to pay bribes through operations in high-risk countries like Uzbekistan or the Philippines, even though the vast majority of its subsidiaries and operations are centered in a low-risk country like Norway. Consequently, bribery risk arising from upwards outlier countries would have been underestimated.

Given that country-level bribery risk is used to calculate the Operating Countries variable in the FBRI, one might concern about endogeneity issues when comparing the FBRI with the listing country bribery risk scores. However, since the Operating Country score is the average

TRACE score of the subsidiaries' three most risky incorporation countries, the variable might be correlated to the primary listing country but is not a function of it, resolving the endogeneity concerns.

The same logic is applied for the variable Subsidiary Industries. Conglomerates often operate in many different industries, some more exposed to bribery than others. For this research, operating sectors are segmented into twelve different industries, as depicted in Appendix B. The segmentation is leaned on previous research, proposing systematic differences in bribery risk across these industries. For instance, the OECD WGB (2015) highlights the harmful consequences of corruption in the extraction, utilities, and health sectors. Feinstein et al. (2011: 16) elaborate that intense personnel exchange between the governments, the military, and suppliers increases bribery risk in the defense industry. Finally, the categorization of industries in the BPI (2011) and OECD-FBR (2014) serves as a basis for defining a nuanced yet concise industry segregation for our analysis.

To map the given SIC codes of subsidiaries retrieved from Orbis, a list is created which maps each of the possible three-digit SIC codes to one of the twelve defined industries.[8] The Subsidiary Industries score is calculated analogously to the Operating Countries score by calculating the arithmetic average of the three industries with the highest bribery risk following the Industry Bribery Risk Score (IBRS). Section 4.2.2 outlines in detail how bribery risk ranks and the IBRS are assigned to the twelve industries.

4.2.1.2 Ownership structure

State ownership implies closer connections to public officials and politicians, making bribery safer for the involved parties as mutual trust is established and interests are aligned. Although state ownership does not automatically imply corruption, as indicated by equivocal empirical results (Billon & Gillanders 2016:1076), it still constitutes a red flag. In a survey conducted by the OECD (2018:11-12) 42% of SOE employees responded that corrupt practices occurred in the organization over the last three years, while relations to the government were perceived as the major cause of integrity issues. For this reason, Ownership Structure is incorporated in the FBRI as a potential red flag.

The scores are assigned based on the percentage of shares owned by the state. For ownership of 0-5%, a score of 0 is assigned to the firm. We decided on this restriction since all observed

[8] Refer to Appendix M for the complete mapping list.

companies are owned by the Norwegian government through the GPFG to a small extent. A minor share that is owned by a government through an investment fund that is diversified across more than a thousand companies does neither imply close personal ties nor particular interests of a government to the investee. For ownership shares between 5-25%, the state can be assumed to be a substantial blockholder. Hence, a score of 50 is assigned for companies with state ownership in that range. For companies with more than 25% state ownership, a score of 100 is assigned as the state would have blocking minority for the most important decisions taking on shareholder level in many countries, including the UK and Germany (Goergen et al. 2008:45; Mills et al. 2019). Hence, a government owning more than 25% of total shares may well be decisive for strategic decisions affecting the long-term success of a company. As a consequence of the substantial ownership share, a government is incentivized to interfere in business practices to ensure its interests. There is a clear risk that highly entangled ties between the state and the firm are established in such cases.

4.2.1.3 Political Exposure

Political exposure can materialize either when a firm's owners, its board members, or other key employees of a firm hold government, military, or political positions or where such a position is held by these individual's close relatives. Such constellations can, directly or indirectly, be leveraged to influence government decisions improperly (TRACE 2019a). Such connections do not necessarily signify illegitimate behavior, but when the association with government bodies goes beyond what can reasonably be expected within standard business practices, it is a red flag calling for closer investigation.

Political proximity is estimated by identifying the number of politically exposed persons at the board level using the PEP indicator from the ORBIS database. Scores are assigned based on the total number of PEPs in the firms' executive and supervisory boards. A score of zero is allocated when no politically exposed persons could be identified. Firms with one to three PEPs at board level receive a score of 50, and firms with four to six PEPs a score of 75. Firms with more than six PEPs are allocated a maximum score of 100.

4.2.1.4 Previous Allegations

As mentioned in section 3.4.1, it is not straightforward whether previous allegations indicate an elevated potential risk of a firm being prospectively corrupt. Enforcement actions can be initiated by the U.S. Department of Justice (DOJ), the U.S. Securities and Exchange Commission (SEC), and other institutions from signatories of the OECD Anti-Bribery

Convention (Sanyal & Samanta 2011:153). Besides cross-border enforcement, domestic investigations may also be conducted by national agencies. However, accessing the information on state-level inspection has numerous obstacles. The quality and strength of domestic enforcement mechanisms are correlated with the corruption risk in a respective country (Anne van Aaken 2010:205). The authors show that in countries where corruption is endemic, the judiciary may also be distorted or exposed to threats. Moreover, many governments do not reveal whom they sanction under criminal law. As a result, the extent of information regarding former enforcement cases is incomplete.

After carefully considering both its advantages and drawbacks, we decided to include both international and domestic enforcement cases in our analysis of previous allegations. Cases are considered provided that legal enforcement sanctions were undertaken against either the corporation or its managers. Actuality of considered cases is ensured by only including allegations that occurred over the last five years. A score of 100 is assigned to firms with bribery allegations within the last five years, while a score of zero is allocated provided that no misconduct was detected.

We acknowledge that the Previous Allegations variable might be tilted in favor of small firms because they are less likely to be investigated by enforcement bodies, as they might not be able to bear the cost of a settlement. Part of the fine is usually allocated to the enforcement bodies to cover the expenses which can easily be accumulated to a two- or three-digit million-dollar figure. However, since the GPFG is mainly invested in large, publicly listed equities, we decided to not address this issue through a different weighing of the variable in respect to the firm size, since setting weights would be highly discretionary and introduce additional complexity to the FBRI.

4.2.1.5 Bribery Prevention

Even though public reporting on anti-bribery initiatives cannot be equated with actual anti-bribery performance, it provides an opportunity for companies to focus on their practices and drives improvement (Transparency International 2014). We use the methodology of TI's Transparency in Corporate Reporting (TCR) as a benchmark to assess the quality of anti-corruption initiatives and public disclosure practices. By implementing a set of predefined reporting items, the TCR checks the existence of publicly available information on 26 items across three dimensions: reporting on anti-corruption programs (1), organizational transparency (2), and country-by-country reporting (3). Given the time constraints and the

focus on bribery prevention, we focus our investigation on anti-corruption (1) and organizational transparency (2) while neglecting country-by-country reporting (3). A concise set of six components is created, which are listed in Appendix C. The chosen components are considered the most suitable for evaluating the effectiveness of the practices in place to prevent bribery. The information is gathered by analyzing the company's code of conduct, CSR reporting, anti-corruption reports, annual reports, and corporate websites. Four of the components are scored either with 0 or 1, while two components are given a score of 0, 1, 2, or 3, with lower scores indicating worse performance and/or less transparency. The final score, which ranges between 0 and 10, is calculated by adding up the scores for the six elements. Lastly, the scores are inverted and normalized on a range from 0 to 100 to generate the final *Bribery Prevention* score, with higher scores indicating higher bribery risk.

4.2.1.6 Weight assignment

The FBRI is calculated as a weighted average of the variable scores. In parallel with its underlying variables, the FBRI is scored in a range between 0 and 100. For company *i* and the chosen variables *j* (with $j \in \{1,2,3,4,5,6\}$), the FBRI is calculated as a linear function of the variable weights (w_j) and the respective variable scores ($v_{i,j}$) using formula *(i)*:

$$FBRI_i = \sum_{j=1}^{6} w_j \, v_{i,j} \qquad (i)$$

Allocating weights to the variables is a crucial part of building the FBRI, due to its high susceptibility not only to the variable scores but also to the assigned weights. Consequently, careful consideration is given to the appointment of weights. However, difficulties in measuring corruption and the lack of comprehensive empirical studies to quantify the impact of different corruption drivers on firm bribery risk hamper an accurate determination of weights.

A firm's cultural and organizational setup shapes the opportunity, deterrence, and motivation to pay bribes from the inside out, and hence, strongly impacts organizations' tendency for respective misconduct. This is supported by Bussmann et al. (2017:271), who find in a survey-based study that for German companies with a strong compliance system, managers of German and Russian subsidiaries do not show significantly different willingness to engage in corruption. Nonetheless, recent investigations like the Deutsche Bank scandal in China and

Russia[9] show that companies behave opportunistically concerning the environment where they operate (TRACE 2021). Despite strong anti-corruption policies and compliant behavior in domestic low-corruption markets, when exposed to a more corrupt environment, several companies have managed to utilize bribes to gain a competitive advantage (Pollack & Allern 2018:79). Consequently, the accumulated weight of variables measuring the firm-level bribery risk is weighted with 40%, closely followed by the country-level risk weight of 35%. The remainder of 25% is assigned to the industry-level risk (Table 3).

The assumptions behind the weight assignment are backed by previous research. Cosenz and Noto (2014) apply a dynamic simulation model to research how different assumptions of country-level corruption risk and customer composition matter for a company's tendency to pay bribes. They find that both factors have a significant impact on the likelihood to pay bribes as well as the size of illicit payments. However, assuming different scenarios, the country-specific risk level is found to be more important than the customer base composition (Cosenz & Noto 2014:247-52), which is in the FBRI indirectly measured by the industry-level risk score.

Within the firm-level risk factors, the variables Ownership Structure and Previous Allegations are weighted with 5%, respectively. As discussed before, the previous involvement in bribery cases does not necessarily translate into an increased prospective bribery risk. Similarly, previous research discusses arguments for and against the assumption that public ownership increases firm-level bribery risk (Billon & Gillanders 2016:1076). Since Previous Allegations is a binary variable with scores of either 0 or 100 and Ownership Structure can take on three values (0, 50, and 100), their respective standard deviations are high. In an attempt to counterbalance this, relatively low weights are assigned to the two factors.

Due to the high relevance of a company's compliance program (Bussmann et al. 2017:257), the Bribery Prevention variable reflecting a company's disclosures on anti-corruption endeavors receives the highest weight among the firm-level variables (Table 3). Finally, Political Exposure is assigned half the weight of Bribery Prevention. Although ties to the government constitute a relevant red flag for bribery, sound internal controls and compliance

[9] On January 8, 2021, Deutsche Bank AG agreed to pay a sum of $122 million to US enforcement bodies DOJ and SEC to reach a Deferred Prosecution Agreement. Deutsche Bank was alleged to have bribed officials and their close relatives in China, Saudi Arabia, and the United Arab Emirates, while also offered employment opportunities to foreign officials' relatives in China and Russia.

mechanisms like whistleblower protection can mitigate opportunistic behavior (Bussmann et al. 2017:217).

Table 3: Weight assignment across variables

Risk level	Aggregated weights by risk level	Variable name	Assigned weights
Country-level	35%	Operating Countries	35%
Industry-level	25%	Subsidiary Industries	25%
Firm level	40%	Bribery Prevention	20%
		Political Exposure	10%
		Ownership Structure	5%
		Previous Allegations	5%

4.2.2 Quantitative discrimination of bribery risk across industries

The approximately 9200 portfolio companies of the GPFG operate in various industries. As summarized in section 3.3, specific industry characteristics can lead to different bribery opportunities for companies. However, to the best of our knowledge, an indicator that measures the differences in bribery risk across industries has not yet been developed. A study focusing on the perception of foreign bribery by sector is the survey of the Bribe Payers Index conducted by Transparency International in 2011. The survey gathers business executives' views on the likelihood that bribes are paid across 19 different business sectors (Transparency International 2011:14).

The OECD Foreign Bribery Report also differentiates industries based on their inherent bribery risk based on enforcement cases in the US, UK, and other European countries. In total, enforcement data from 427 foreign bribery cases is applied to measure transnational corruption. It ranks 14 business sectors based on the total number of firms sanctioned for foreign bribery in each sector. The results indicate that two-thirds of the foreign bribery cases occurred in four sectors: extraction (19%), construction (15%), transportation (15%), and telecommunication (10%).

As stated in the literature review, both the TI-BPI and the OECD-FBR have shortcomings. Since the TI-BPI relies on perception-based measures, its estimates could suffer from

subjectivity of the responses and the huge confidence intervals of the results. In addition, given that it evaluates the perception of business personnel in 30 different countries, the variation in the number and the characteristics of the respondents can lead to further biases. The findings of the FBR need to be considered carefully, too. The decisions of the enforcement agencies regarding which companies to investigate could introduce a selection bias towards large firms and sectors that are perceived as more prone to bribery.

For the reasons mentioned above, we create an industry bribery risk score (IBRS), which aggregates the findings of both reports. These sources complement each other by providing both perception-based bribery risk evaluation (BPI) and analysis of enforcement actions (OECD-FBR). Both publications rank different business sectors based on how prone they are to bribery risk but use different measurement scales and industry classifications. BPI indicates elevated bribery risk with higher scores (the maximum score of 10 corresponds with the view that companies in that sector never bribe and 0 that they always do). In the FBR, the share of enforcement cases for each industry is stated as a percentage of the total number of enforcement cases. To aggregate these two sources and to calculate a risk score for each industry, the following steps have been applied:

Step 1: Because the two publications employ different industry classifications, the industries in each report are mapped to the twelve industries that we defined (column 1 in Table 4). As an illustration, the TI-BPI describes "light manufacturing" and "heavy manufacturing" separately, while our chosen industry classification does not distinguish between these sub-categories. Since the TI-BPI assigned a bribery risk score to both these categories, the average of these scores is calculated to arrive at the risk score of the manufacturing sector. Applying this approach, a score is assigned to each sector based on the TI-BPI bribery scores (column 2 in Table 4).

Step 2: The OECD-FBR evaluates industries based on the share of the enforced cases that occurred in a given sector compared to the total number of enforced cases included in the study. For example, the extractive industry ranks the highest, given that 19% of all considered foreign bribery cases occurred in this sector. 15% of the cases have taken place in the construction sector (column 3 in Table 4). However, the OECD-FBR does not take into account the relative size of the industries compared to each other. Potentially, more deals, which could be subject to bribery, might be conducted in the extractive sector than in construction. If so, the fact that 15% of the enforcement cases (only 4% lower than in the extractive sector) materialized in construction may suggest that this sector is more prone to bribery risk than the extractive

industry. Referring to the uniformity assumption of Escresa and Picci (2017:198), the underlying assumption is that if corruption risk would be equally distributed across all industries, the share of enforcement cases should equate to the share of GDP size of each industry.

Step 3: To account for size when assigning bribery risk to a given sector, the worldwide GDP in US dollars per industry is downloaded from the EIKON database (column 4 in Table 4) and the relative share of GDP (column 5) calculated for each industry *i:*

$$GDP\ share_i = \frac{EIKON\ GDP\ share_i}{\sum_{j=1}^{12} EIKON\ GDP\ share_j} \qquad \text{for all } i,j \in \mathbb{N} \cap [1;12] \qquad \textit{(ii)}$$

Step 4: A metric named Enforcement Ratio is created, which divides the share of enforcement cases (from OECD-FBR) by the share of world-level GDP of the respective sectors.

$$Enforcement\ Ratio_i = \frac{Enforcement\ share_i}{GDP\ share_i} \qquad \text{for all } i \in \mathbb{N} \cap [1;12] \qquad \textit{(iii)}$$

The uniformity assumption of Escresa and Picci (2017) implies that an Enforcement Ratio value larger than one indicates that disproportionately more enforcement cases occurred in the sector than expected given its size (column 6 in Table 4). For instance, 15% of the enforcement cases occurred in construction, but the sector's world-level GDP share compared to the total world-level GDP is only 4.2%. This indicates that more companies were enforced for bribery in the construction industry, as expected given the industry's size.

Step 5: Next, using both the average scores for the BPI-TI and the enforcement ratio (columns 2 and 6 respectively), the scores are expressed as standard deviations from the mean (columns 7 and 8 in Table 4). Given that TI-BPI indicates lower bribery risk for higher scores, the inverted algebraic sign is applied to reverse its scale. Following the example of the TRACE Matrix (TRACE 2019b), inputs of different dimensions are normalized into standard deviations from mean to align the dimensions for mathematical operations.

Step 6 & 7: The information of both sources is accumulated by the simple average of the standard deviations from mean for each industry in columns 7 and 8. The resulting values in column 9 can be interpreted as an accumulated indicator that reflects both information from the BPI and the size-adjusted enforcement case data from the FBR. We acknowledge that through the accumulation process, information can be lost. For example, by weighing both data points equally, it is assumed that both factors are equally important to measure the industry

bribery risk. Since we cannot verify whether this assumption is accurate, the described calculation can only result in an approximation for differences in bribery risk across industries. Therefore, the decision is made not to normalize the values in column 9 on a scale from 0 to 100 but rather to rank the industries and assign scores with equal intervals, where 0 is allocated to the lowest and 100 to the highest rank (column 11). These scores are referred to as the Industry Bribery Risk Score (IBRS) in the following sections.

Table 4: Calculation of the Industry Bribery Risk Score

Industries	TI-BPI	FBR Enforcement share	EIKON Industry world GDP (bn$)	Industry share of world GDP	Enforcement ratio	Enforcem. ratio Std. Dev. from Mean	TI-BPI Std. Dev. from Mean	Average Std. Dev. from Mean	Rank	IBRS
1	2	3	4	5	6	7	8	9	10	11
Construction	5.30	15%	2293	4.2%	3.57	0.79	2.92	1.85	1	100.00
Defense	6.60	5%	443	0.8%	6.16	2.15	-0.09	1.03	2	90.91
Transportation	6.70	15%	1624	3.0%	5.04	1.56	-0.32	0.62	3	81.82
Utilities	6.25	9%	2079	3.8%	2.36	0.16	0.72	0.44	4	72.73
Extraction	6.25	19%	7057	12.9%	1.47	-0.31	0.72	0.21	5	63.64
Human health	6.40	8%	3081	5.6%	1.42	-0.34	0.38	0.02	6	54.55
Telecommunication	6.70	10%	1999	3.7%	2.73	0.35	-0.32	0.02	7	45.45
Financial services	6.50	1%	7192	13.2%	0.08	-1.04	0.15	-0.45	8	36.36
Service Industries	6.55	2%	4617	8.5%	0.24	-0.96	0.03	-0.46	9	27.27
Agr., Forestry & Fishing	6.87	4%	2113	3.9%	1.03	-0.54	-0.70	-0.62	10	18.18
Wholesale and retail	6.80	4%	6404	11.7%	0.34	-0.90	-0.55	-0.72	11	9.09
Manufacturing	6.87	8%	15638	28.7%	0.28	-0.93	-0.70	-0.82	12	0.00
	Step 1	Step 2	Step 3	Step 4		Step 5		Step 6	Step 7	

One should be aware of the drawbacks attached to the above-described approach. Firstly, both the data from BPI (2011) and the FBR (2014) are quite old in relative terms. Furthermore, the sectoral GDP data for 2019 retrieved from EIKON sums up to 55 trillion USD, while the World Bank reported GDP to be at $87.7 trillion that year (World Bank 2021a). We remark that the gap might introduce a bias to the results if GDP data of specific sectors are either over- or undervalued in EIKON.

Nevertheless, there are factors in support of the chosen approach. Firstly, the age of the BPI report might have a modest effect as perception-based indices tend to change slowly over time (Fazekas et al. 2013:3). Furthermore, the time span comprised by the OECD FBR from 1999 to 2014 is quite long. Hence, the inclusion of cases after 2014 could lead to some variation in the results, though it is not expected that the enforcement cases shifted dramatically for the industries. This is validated by the TRACE Global Enforcement Report, which summarizes the industries that have experienced the most enforcement actions concerning alleged bribery of public officials as of 31 December 2020. According to the report, the extractive industry represents the highest number of bribery investigations (20%), followed by the construction sector with approximately 17% (TRACE 2020b:18).

Additionally, the results of the IBRS correspond with previous research on industries of high bribery risk. Chan and Owusu (2017:41) argue that the construction sector is one of the most corrupt industries, and it also ranks first in our score. Other industries found as corruption-prone by previous literature like extraction (Kolstad & Wiig 2013), defense (Feinstein et al. 2011), utilities (Kenny & Søreide 2009), human health (Cohen 2006), and telecommunication (Brzić et al. 2021) all have a risk score above average in (column 9, Table 4).

As an alternative approach to create an indicator of bribery across industries, we aimed to utilize the World Bank Enterprise Survey data. The survey of the World bank comprises 13 items that address the respondent's experience with bribe paying and gift-giving (World Bank 2020). We aimed to examine the bribery incidence, which is the percentage of firms that are requested to pay a bribe at least once, to discriminate bribery risk between industries. However, the industry segmentation available in the data lacks granularity. Most firms are only referred to an industry using a two-digit SIC-Code, rendering it impossible to distinguish between defense and other heavy manufacturing producers, for instance. Consequently, we refrain from the application of the Enterprise Survey data. This underpins the concurrent research gap in the area of industry-level bribery risk, as outlined in section 3.5. As a result, other recent publications, as from Li, S. (2019:55) and Kravtsova and Oshchepkov (2019:16), were also constrained to the BPI data.

By considering both perception-based and enforcement case data, the limited available data on industry-level bribery risk is utilized. The chosen methodology entails a ranking of industries present in the GPFG's portfolio with respect to their inherent bribery risk, which is used to discriminate investments in respect to their bribery risk based on the industries they operate in.

4.2.3 Drawing a sample

The FBRI is employed to analyze whether the bribery risk of the listing country, as applied in the comparison across funds, is an accurate measure for a firm's actual bribery risk. Since it requires extensive manual data collection, calculating the FBRI scores for all equities of the GPFG is not feasible. Thus, a sample is drawn to examine a subset of firms in detail. Given the time constraints, the sample is limited to $n = 80$ companies. We decided to draw 20 companies from each of the four TRACE country risk categories represented in the portfolio (Figure 4). This ensures that firms in the sample represent the full range of country risk levels since firms

with *very low* and *moderate* risk categories are overrepresented in the GPFG portfolio with 67,9% and 22,6% compared to only 1.3% of equities in the *high* category[10].

Additionally, systematic differences in industry-level bribery risk across the four subsamples could bias the analysis due to the confined sample size. For instance, if the 20 selected companies from the *high*-country risk category would turn out by chance to operate in high-risk industries like construction or defense, while the companies drawn from the *very low* country risk category operate in low-risk industries like manufacturing, differences in the FBRI might result from sample-specific differences in the industry. To limit this effect, 10 out of the 20 companies of each subsample are randomly selected from industries with *increased* and *moderate* industry-specific risk (see Figure 4). Thereby, the sample can still reflect eventual systematic differences in the industry between the country-risk categories to a certain degree. All industries with an average standard deviation from mean larger than zero (column 9, Table 4) present an *increased* risk, as a positive value reflects an aggregated risk score above average. Analogously, all industries with a respective negative value are clustered in the *moderate* industry risk category.

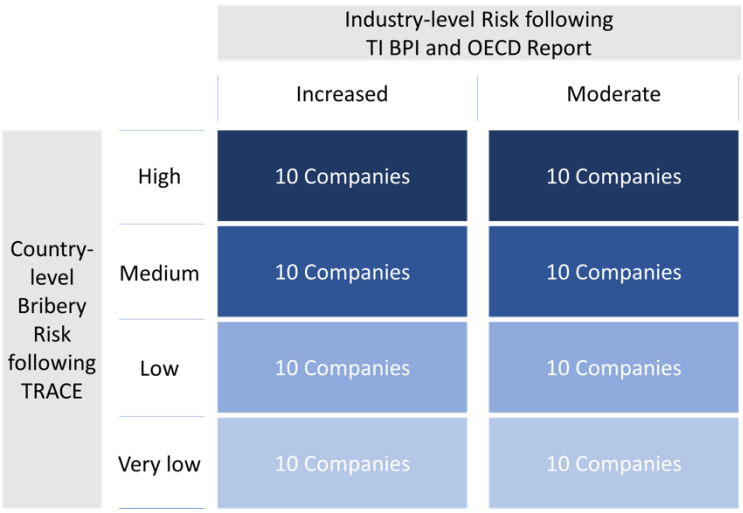

Figure 4: Drawing the sample for analyzing the second hypothesis

The ten companies within each of the eight resulting clusters are randomly drawn using the statistical software R[11]. To estimate the firm-level bribery risk, the FBRI score is calculated for all firms in the sample. For testing the second hypothesis, these scores are compared to the

[10] For a detailed explanation of the clustering of countries into different risk categories in the TRACE Matrix refer to section 5.1.2.
[11] See Appendix D for the exhaustive list of the sample companies.

firms' listing country-level risk scores. In addition, average FBRI scores are calculated for the different country level risk categories.

4.2.4 OLS regression, ANOVA, and Welch t-test

For examining the capability of listing country risk scores (*LCRS*) to explain firm level risk measured by the FBRI, a univariate ordinary least squares (OLS) regression is applied with FBRI being the independent variable. We chose an OLS regression over correlations since regressions allow deeper analyses through the provision of error terms. Thereby, the strength of the linear relation between both variables, as well as explained variation in FBRI can be analyzed. The underlying regression function can be written as shown in formula *(iv):*

$$FBRI_i = \alpha + \beta * LCRS_i + e_i \qquad (iv)$$

To test different relationships, we also compute an exponential and third-degree polynomial regression. We do not include control variables like the country or industry of the particular firm, as the FBRI is a function of these variables and thus, inappropriate as controls. The objective of this exercise is to identify whether the listing country bribery risk is an appropriate direct estimator of the firm bribery risk, resulting from these variables. We do not aim to analyze within-industry or -country variations explained by the LCRS, but rather the general explanatory power when combining different factors affecting the bribery risk at the firm level, reflected by the FBRI. Therefore, we did not include controls in our regression.

Listing country risk scores might explain differences in firm-level risk better for *very low* or *high* countries than for other categories. Aiming to analyze respective variations, the average FBRI scores are calculated for each of the four country-risk categories *high*, *moderate*, *low*, and *very low*. As a first step, an ANOVA test is applied to test whether the differences in group means are jointly significant. ANOVA produces the F-statistic, which compares the amount of systematic variance in the data to the amount of unsystematic variance. Since ANOVA is an omnibus test, it tests the overall effect (Field et al. 2012:375). Consequently, it does not provide specific information about the differences within the groups, or the direction of differences in mean. The Welch t-test is applied to test between which of the various pairs of means the difference is significant.

Both the Welch t-test and the ANOVA, being parametric tests,[12] rely on a set of assumptions. The assumptions of parametric tests, described by Field et al. (2012:168), and the statistical tests used to assess the validity of these assumptions are summarized using Table 5 below. The results of testing the first two assumptions are detailed in Appendix E, which shows that neither assumption can be rejected. Since the FBRI is a numerical variable with a finite scale between 0 and 100, the third assumption is satisfied. Independence is also achieved because the firms can be assumed to be independent of each other and are randomly selected.

Table 5: Parametric test assumptions

Assumption	Validity test	Description
Normally distributed data	Shapiro–Wilk test	The scores in the sample are compared to a normally distributed set of scores with the same mean and standard deviation. If the test is non-significant ($p>0.05$), the distribution of the sample is not significantly different from a normal distribution. Hence the T-test can be applied.
Homogeneity of variance[13]	Levene -test	It tests the null hypothesis that the variances in the different groups are equal. If the test is non-significant ($p>0.05$), one cannot reject that the variances are equal and the assumption is tenable.
Interval data	NA	Data point values should be numerical variables.
Independence	NA	The variables for different groups should be independent of each other.

4.3 The Fama-French five-factor model plus Momentum

This section outlines the methodology for analyzing the financial returns of companies identified under Hypothesis II as high and modest bribery risk firms. We examine whether the Norwegian Pension fund previously benefitted from being invested in the 20 firms with the highest and lowest FBRI scores respectively, in terms of abnormal returns. Since financial theory is not the focus of this thesis, the technical background of the applied model is explained in brevity.

Financial theory argues that additional returns always come at the expense of additional risk (Sharpe 1966:119). Plenty of models were created over time to explain how risk and return should be considered in rational investment decisions and what type of risk is relevant for explaining returns (Markowitz 1999). Fama and French found empirical evidence that five factors are capable of explaining variations in stock returns (Fama & French 2015). Carhart (1997) suggested already in the 90s that a momentum factor systematically affects stock prices.

[12] A parametric test uses statistical distributions like the t-distribution, and for data to be parametric certain assumptions must be true (Field 2012:167).
[13] This assumption is only required by the ANOVA test since the Welch-test does not assume equal variances.

Previous empirical studies showed that extending the Fama-French factors by a Momentum variable increases the model's predictions of historic returns, although the importance of the factors also varies over time (Arnott et al. 2019:24; Gupta & Kelly 2019:33; Tai 2003:382). The six factors are defined by Fama and French (2015) as:

- *SMB:* Small minus Big. Indicates the delta returns of the smallest 30% of firms to the largest 30% on a market. Size is measured as market capitalization.
- *HML:* High minus Low. Indicates the delta returns of the 30% of firms with the highest Book-to-Market Ratio to the 30% with the lowest ratio on a market. The Book-to-Market Ratio is measured as book value of a firm's equity divided by the market value.
- *RMW:* Robust minus Weak. Indicates the delta returns of the 30% of firms with the highest profitability to the 30% with the lowest profitability on a market. Profitability is measured as the earnings before taxes, depreciation, and amortization (EBTDA) divided by the book equity.
- *CMA:* Conservative minus Aggressive. Indicates the delta returns of the 30% of firms with the lowest investments to the 30% with the highest investments on a market. Investments are measured as the relative change in a firm's total assets.
- *MOM:* Momentum. Indicates the delta returns of the 30% of firms with the highest returns in the last period to the 30% with the highest returns in the last period on a market.
- $r_M - r_f$*:* The excess return of the market, that is the market returns less the return of a risk-free asset. It indicates the financial returns of the overall market. Firms that correlate strongly with the market have a higher risk than those more robust towards external shocks than the market.

The consequent multivariate regression can be written as shown in formula *(v)*:

$$r_i - r_f = \alpha_i + \beta_i(r_M - r_f) + s_i SMB + h_i HML + r_i RMW + c_i CMA + m_i MOM + e_i \quad (v)$$

Provided the alpha is found to be significantly different from zero, an abnormal return is indicated by the model. For a significantly positive (negative) alpha, returns are higher (lower) than the risk factors would suggest. Such a return is not explained by the risk factors and thus, is considered as an abnormal return (Jensen 1968:394). To analyze the returns from high- and low-risk firms separately, the Fama-French five-factor model plus Momentum, as written in Formula *(v)*, is applied on monthly returns over a period of ten years, from 2010 until 2019.

For the independent variables, the FTSE All-World Equity is used as the market portfolio r_M, as it represents a globally diversified index of equities and is the benchmark index of the GPFG. The 1-month US treasury bill is considered as the risk-free rate r_f, since its volatility, market, and inflation risk can be assumed to be negligibly low (Mukherji 2011:75).

To distinguish returns of high and low bribery risk companies, two portfolios High (H) and Low (L) are constructed. Each portfolio consists of the top and bottom quartile of our 80 sample firms following their FBRI score. Thus, Portfolio H includes the 20 companies with the highest FBRI scores, indicating elevated bribery risk (see Appendix L). On the contrary, Portfolio L includes the 20 companies with the lowest FBRI scores, indicating modest bribery risk. Each portfolio is created by weighing the equities proportionally to their respective weights in the GPFG over the time span from 2010 to 2019. Thereby, we replicate the historic adjustments of these equities in the GPFG portfolio. The weights are calculated by accessing the historic portfolio composition from the NBIM website for each year.

The analysis is divided into two parts. At first, a long-short portfolio is examined, which buys portfolio L and shorts portfolio H. By doing so, the return of buying the stocks with low bribery risk and shorting those of high bribery risk is mimicked. Afterward, returns of portfolios H and L are regressed on the Fama-French model separately.

As the independent variable, the excess returns of portfolios H and L are applied for the separated analysis of the two portfolios. Excess returns are a different concept than abnormal returns. They describe the returns of an asset that exceed the return of the risk-free rate (r_f). For portfolio L, (H) the dependent variable is thus expressed as $r_L - r_f$ ($r_H - r_f$). In contrast, the returns of the long-short portfolio are not subtracted by the risk-free rate, since the difference in excess returns equals the difference in absolute returns of the two portfolios:

$$(r_L - r_f) - (r_H - r_f) = r_L - r_H \qquad (vi)$$

Finally, the long-short portfolio, portfolio L, and H are constructed assigning equal weights. These portfolios do not mimic the GPFG but rather show the differences in returns for H and L when the high- and low-risk equities are equally weighted.

5 Data

The data collection process consists of three separate parts. Firstly, we access information regarding the portfolio of the GPFG and the benchmark SWFs is. The data is used to compare the funds' bribery risk exposure. The second segment supports the calculation of FBRI scores by gathering data ofnthe underlying variables. Finally, data of the historic returns is collected that is used to calculate the abnormal returns.

5.1 SWF portfolios and the TRACE Matrix

5.1.1 Portfolio data of SWFs

We downloaded data describing the equity investments of the SWFs from their respective websites. The datasets contain the following information for each equity: name of the firm, listing country, and market value of the investment in local currency. Additionally, the data set of the GPFG includes the incorporation country, industry classification, as well as voting and ownership share. In some cases, the data is only available in textual format, so the statistical software R is used to prepare the data for analysis.[14]

5.1.2 TRACE Bribery Risk Matrix

The TRACE Matrix aims to provide a resource for quantifying bribery risk. The Matrix is accessed by downloading the 2019 TRACE Matrix Information Pack, which is publicly available through the website of TRACE International. The collection outlines the analytical model used to produce the Matrix, describes the methodology regarding the data collection procedure and lists the underlying data sources. The Matrix employs on average 52 datapoints per country to assign an overall bribery risk score for 194 nations. Each score ranges between zero and one hundred with lower values indicating lower bribery risk and is calculated as the weighted average of four separate risk domains. The four domains, together with the overall bribery score are summarized using Table 6 below. Analyzing each domain separately can provide a more nuanced understanding of the particular aspects of the countries' bribery risk profiles (TRACE 2019b:1). As mentioned before, TRACE clusters countries in five different bribery risk categories as shown in Appendix A.

[14] For information on the availability of the R script, please refer to Appendix N.

Table 6: Risk domains of the TRACE Matrix

Domain Name	Underlying data sources	Weight	Description of the risk domain
Opportunity	26	40%	Concerns the immediate relation between a company and public officials
Deterrence	15	15%	Considers both formal enforcement mechanisms and less formal ways in which bribery is discouraged
Transparency	12	22.5%	Addresses the accessibility of public sector information
Oversight	16	22.5%	Examines the freedom of non-governmental institutions
Overall bribery risk score	52 (On average)		Represents the country-level contributors of business bribery risk

5.2 Firm-level corruption risk indicator

As detailed in the introductory chapters, previous research shows that besides country-specific factors, industry-, and firm-level characteristics further influence the risk of being involved in bribery. To account for these additional risk components, the FBRI is constructed. The indicator is intended to capture red flags, i.e., certain facts that can signal a heightened risk of public bribery. It utilizes a set of databases as well as publicly available information. Bureau van Dijk's Orbis database is applied to gather information on subsidiary locations, business sectors, ownership structure, and the presence of politically exposed persons on a company's management level. Corporate websites are accessed to collect information about governance, compliance, and transparency.

5.2.1 Data collection of FBRI variables

5.2.1.1 Operating Countries and Subsidiary Industries

A dataset containing all subsidiaries, their country of operation, as well as the primary business activity through a 3-digit Standard Industrial Classification (SIC) code, are downloaded from the Orbis database for each firm in the sample. All companies are considered as subsidiaries of which the parent company is the ultimate global owner. This means that it has a direct or indirect majority of voting shares or contractual-based dominant influence. On average, the firms in the sample conduct their operations in eight countries and across four out of the 12 predefined industries (Table 7).

Table 7: Descriptive statistics of the sample companies

	Min	Max	Mean	Standard deviation
# Operating countries per firm	1	77	8.2	13.9
# Unique business sectors per firm	1	9	4.23	2.55
# different 3-digit SIC codes per firm	1	63	10.8	13.2

While the country information is available for almost all subsidiaries, around 15% of the subsidiaries have no SIC Code assigned. The missing SIC Codes are looked up manually by the authors using additional private company databases like Dun & BroadStreet Business Directory, Bloomberg, Crunchbase, PitchBook, and websites of the respective companies. Subsidiaries for which the operating industry could not be determined are neglected in the further analysis. As this share is less than 5% of the total subsidiaries, the impact of those missing values is estimated to be negligible. The results of analyzing the collected data of subsidiary countries and sectors are outlined in Appendices F and G.

5.2.1.2 Ownership structure

Information regarding the firms' shareholder structure is accessed using the Orbis database. Orbis gathers its data for Ownership Structure from several sources, including stock exchanges and other data providers like Factset and WhoOwnsWhom.

Orbis states direct and indirect ownership per shareholder data. Direct ownership describes when a shareholder invested directly in the subsidiary, while indirect ownership includes ownership through another company or holding. The latter is only considered if the ultimate shareholder has a controlling influence on the holding, which owns the given company.

Public ownership is determined by considering both direct and indirect government ownership cumulatively. For instance, following Orbis, the Government of the Arab Republic of Egypt is invested in *Egyptian Financial & Industrial Company SAE* through three fully owned corporate vehicles: Metallurgical Industries Holding Company (27.14%), Private Insurance Fund for the Government Sector's Employees (12.26%) and the National Authority for Social Insurance (11.79%). Since the Egyptian government controls all three organizations, the total indirect ownership is calculated as the sum of all three investment vehicles' shares, which is 51.19%. An overview of all firms in the sample with state ownership is presented in Appendix H.

5.2.1.3 Political exposure

Political proximity and government connections are estimated by identifying the number of politically exposed persons at the board level. A comprehensive list of the firms' board of directors was accessed through the Orbis database. Orbis' PEP indicator reveals whether the name of a person in the board is referred to as politically exposed in their database. Besides politicians, their relatives and close personal contacts are also considered to be politically exposed according to this procedure (Bureau van Dijk 2021). The data suffers from the shortcoming that managers with similar or identical names to politicians are highlighted as PEPs as well. Hence, some of the individuals labeled as PEP in Orbis can be assumed to be false positives, meaning that they are not politically exposed in fact. This explains why only nine out of 80 companies in the sample did not have any PEPs on board level. We acknowledge this shortcoming of the data by assigning increasing scores for a higher number of PEPs. Even though the PEP indicator in Orbis is an imperfect measure, we assumed that a larger number of people marked as PEPs translates into closer political connections on average, given that the possibility that one or some of them are indeed politically exposed is higher. An overview of the number of PEPs on board level for all sample companies is provided in Appendix I.

5.2.1.4 Previous allegations

The TRACE Compendium database is used to identify cross-border anti-bribery actions. The database provides detailed enforcement reports on bribery involvement of government officials across international borders. Sources like the Wall Street Journal Risk and Compliance Journal, national databases such as the one from the UK Serious Fraud Office, and newspaper articles are accessed to identify previous cases of domestic bribery allegations. An overview of all considered bribery cases, including the sources and a short description of each case, can be reviewed in Appendix J.

5.2.1.5 Bribery Prevention

Corporate governance and transparency are assessed by evaluating the information disclosed on compliance programs. The anti-corruption effort score is compiled by utilizing publicly available information published on the companies' corporate websites. The data collection is carried out by performing a systematic review of annual reports, code of ethics and business conducts, social responsibility reports, anti-corruption programs, and whistleblowing policies. Although a standardized catalog of six items (Appendix C) is applied to examine a company's anti-corruption endeavors, the evaluation of qualitative data is affected by a certain degree of

subjectivity. Although both authors conducted the analysis independently, subjectivity errors cannot be entirely excluded. An overview of the examined items and their fulfillment for each firm is depicted in Appendix K.

5.2.2 Industry GDP size

Information regarding world-level GDP sectoral data is accessed through the EIKON database. EIKON classifies the industries into numerous sub-categories. These sub-sectors are aggregated to fit the 12 sectors as defined under section 4.2.2 to calculate the total GDP figures for each industry.

5.3 Fama-French factors and returns

Historic returns underlying the variables *SMB*, *HML*, *RMW*, *CMA*, and *MOM* are retrieved from Kenneth French's website (French 2021). The provided data comprises different individual and accumulated markets like emerging and developing countries but is not available on a global level. However, as firms from emerging and developed economies are considered in portfolios L and H, the global Fama-French factors are approximated. Therefore, factors for emerging and developed markets are weighted annually by the share of the global GDP in current US dollar. The global GDP split by emerging and developed markets from 2010 until inclusive 2019 is accessed through the World Bank Databank (World Bank 2021b).

The historical returns of the 1-month US treasury bill for the returns of the risk-free asset r_f are also retrieved from French's website. Being the benchmark index of the GPFG, the FTSE All-World Equity is preferred as an approximation of the market return r_M. Its historical returns are retrieved via Refinitiv EIKON since French provides a different market return r_M, that combines returns of all NYSE, AMEX, and NASDAQ equities.

We retrieved historic monthly returns of the 40 companies included in the two portfolios H and L from EIKON. Some of the equities were not listed at the beginning of 2010. In consequence, we consider only available stock returns to calculate the weighted and unweighted average returns of the portfolios. Additionally, the Chinese company Bestsun Energy Co Ltd from China has missing stock returns over a period from April until September 2015. Returns in this period are neglected from determining the portfolio returns and not set equal to zero.

6 Analysis

This chapter outlines the results of our empirical analysis. First, we present the findings related to the first hypothesis, which examines country-level bribery risk solely. Since the three funds are all globally diversified and have little difference in bribery risk of their domestic countries, we expect not to observe considerable differences in bribery risk exposure among the portfolios. The second hypothesis is targeted at the relation between country-level and firm-specific bribery risk within the GPFG portfolio. Therefore, the analysis expands its scope by considering industry- and firm-level bribery risk factors besides country-level aspects. The FBRI is used as an approximation for the firm-specific bribery risk, as it comprises all three levels of risk determinants. Finally, we outline the results of the Fama-French model on the historic returns of the firms with high and low bribery risk for testing Hypothesis III.

6.1 Country-level bribery risk comparison

This section presents the results of the analysis to examine the first hypothesis, in which the country-level bribery risk of the GPFG is compared to a peer group of three other sovereign wealth funds, consisting of the Dutch ABP, the Superannuation Fund of New Zealand, and the Alaskan APFC.

Hypothesis I: *The country-specific bribery risk exposure in the GPFG is not systematically different than of its peer sovereign wealth funds.*

6.1.1 Comparison of weighted average risk scores

As a first step, a weighted average bribery risk score is calculated for each fund. The score is determined based on the TRACE overall bribery risk score of each investment's primary listing country. As each portfolio consists of a multitude of equities with different investment volumes, each equity is weighted with its investment market value (*IMV*). Consequently, the Total Risk Score (*TRS*) is calculated by considering each investment *i*, with *I* representing the total number of investments in portfolio *p*, as presented in formula *(vii)*.

$$TRS_p = \sum_{i=1}^{I} \frac{IMV_i}{\sum_{i=1}^{I} IMV_i} * TRACE\ Overall\ Bribery\ Risk\ Score_i \qquad (vii)$$

Besides using the total overall bribery risk score of the TRACE Matrix, as depicted in the above formula, weighted risk scores are also determined using the TRACE domains Deterrence, Opportunity, Oversight, and Transparency. Figure 5 summarizes this comparison across the

funds. The red dashed lines imply the average risk scores for the given dimension of the four portfolios.

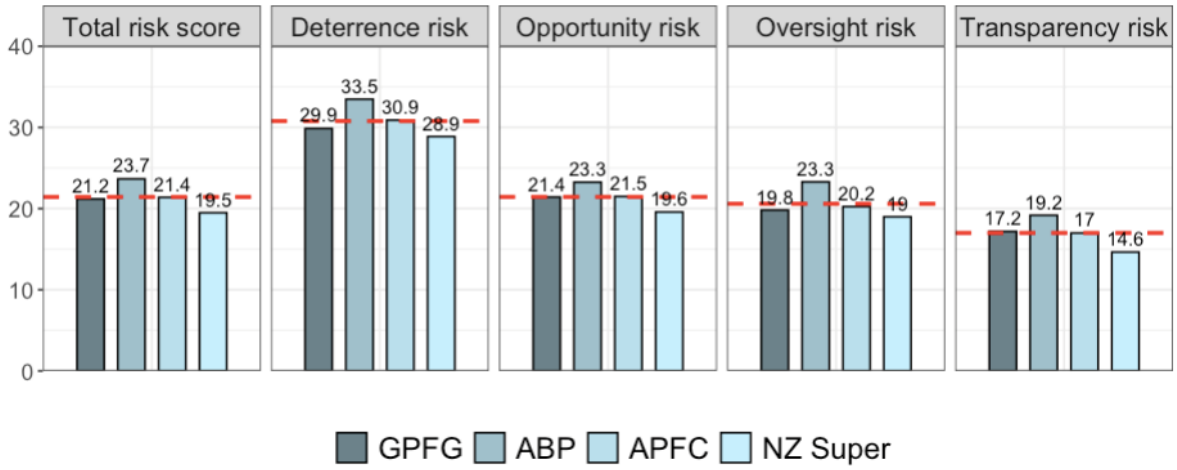

Figure 5: Weighted risk scores based on the TRACE total risk score and the domains

Considering the weighted risk scores, the ABP constitutes the riskiest portfolio. It has the highest country bribery risk for the Total Risk Score and each of the four domains. Apart from the Transparency domain, both the ABP and the APFC have consistently higher average scores than the GPFG. In addition, the weighted scores for the GPFG lie close to the average scores for each dimension, highlighted by the dashed red line.

However, the differences in risk scores among the domains are prominent. The average Deterrence score systematically exceeds all other dimensions across all funds. In contrast to the Oversight and Opportunity domain scores, which have values of around 20 on average, the gap between Deterrence and Transparency is salient. For instance, the Deterrence score for NZ Super (28.9) is almost twice as high as its Transparency score (14.6). For the GPFG, this difference accounts for around 13 points. The implications are twofold. The very low Transparency score implies that investments are on average listed in countries where information about governmental institutions and domestic civil services is easily accessible to the public. On the other hand, the higher Deterrence score signals that anti-bribery enforcement and social condemning of corruption in the invested countries are less effective. This is important for the bribery risk of a country because reporting about and passing anti-bribery laws is of little effectiveness when laws are not appropriately enforced (Søreide 2014:9-10). Since this disparity occurs for each fund, it is an interesting finding in itself but does not imply elevated bribery risk of the GPFG compared to its peers.

The results of the robustness check summarized in Figure 6, underpin the finding that the weighted country-risk score of the GPFG is close to the average of its peer funds. Although the absolute levels of average scores vary across the indicators, the relative locations of the funds' bribery scores to each other are very similar to the findings of the TRACE Matrix. It's important to note that since all sources rely on perception-based information about corruption and partially utilize the same sources, perceptual biases from the self-fulfilling effect of these reports cannot be completely mitigated. However, other challenges, like discretionary decisions in aggregating data and the large confidence intervals of estimates, can be mitigated by applying other indices based on different methodologies.

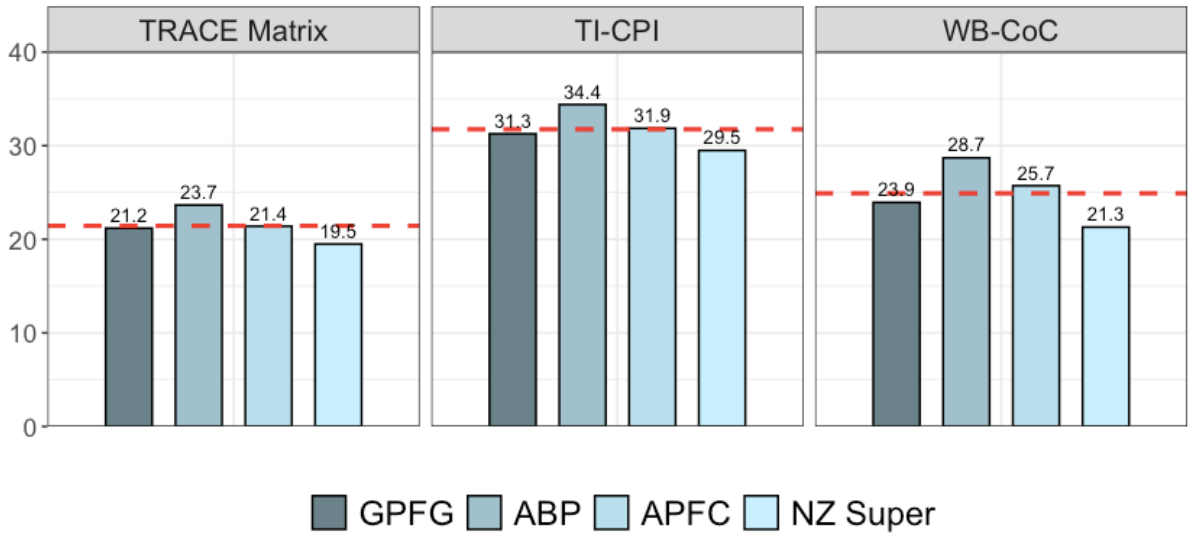

Figure 6: Weighted country-level bribery risk scores robustness check

6.1.2 Comparison of upwards outliers

Analyzing the weighted average scores can be misleading. By solely focusing on averages, an elevated risk posed by the small number of high-risk investments could be negated by the vast number of low-risk equities. Hence, in a more granular analysis, all equities in countries categorized by TRACE as *high* bribery risk environments are compared across the funds. Figure 7 depicts the portfolio share of investments in those countries across the different funds. The GPFG has the largest proportion of *high*-risk investments both when the number of firms and the portfolio value share are examined. With 1.3% of equities (119 of 9202 firms) invested in *high*-risk countries, the Norwegian pension fund has 2.6 times more firms in those countries compared to the ABP, which represents the second highest share of *high*-risk firms with 0.5%. The other two funds mark the bottom line with only 0.1%. Analog inferences arise from the portfolio value share of *high*-country risk investments, although the relative differences

between the GPFG and the ABP and APFC are less severe. This implies that the GPFG's investments in *high* bribery risk countries are smaller relative to its total portfolio than for its peers from Alaska and the Netherlands.

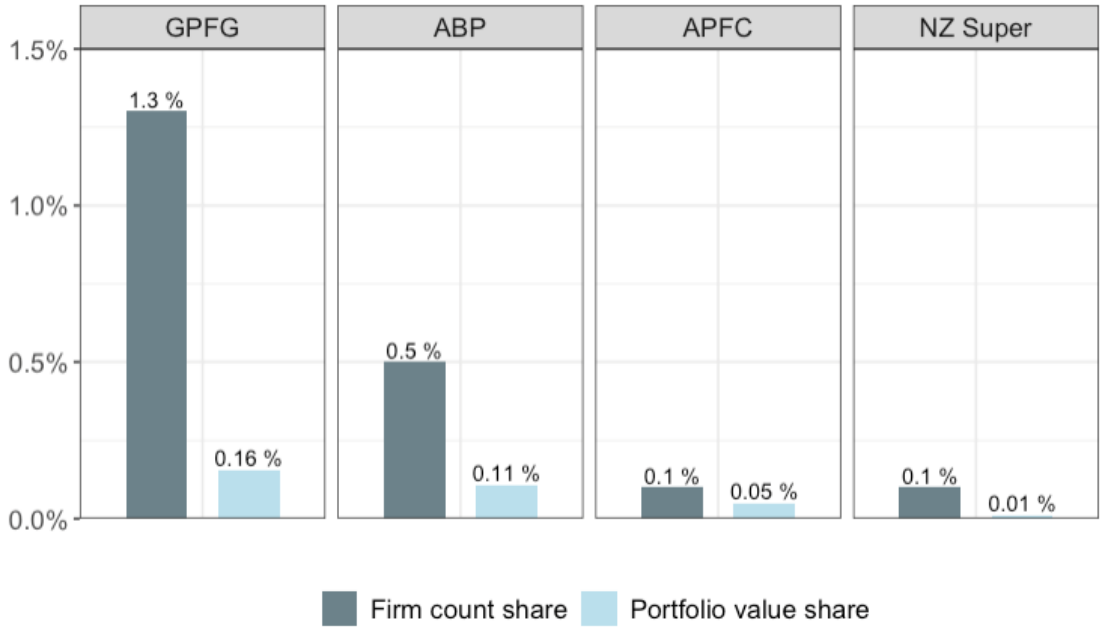

Figure 7: Share of investments in high bribery risk countries across funds

When considering the absolute amount of US-Dollar invested in equities listed in *high*-risk countries, the disparity between the GPFG and its peers becomes even larger, given that the total AUM is by far the highest for the Norwegian fund. The GPFG is invested in 119 firms from *high*-risk countries, whereas ABP includes only 18, APFC nine, and NZ Super four respective equities. The total market value of these investments stated in Million US-Dollar is depicted for each fund in Figure 8.[15] The $1.3 million equity value of the NZ Super seems negligible in comparison with the GPFG's value of around $1.3 billion. Relative to the other portfolios, the amount of capital flowing into firms from *high* bribery risk countries is outstanding for the GPFG. This suggests a higher exposure of bribery risk in the Norwegian oil fund under the condition that the listing country bribery risk is an appropriate indicator for the actual bribery risk of the firms. Identifying whether this assumption is valid is the subject of the analysis in the next section.

[15] 2019 year-end rates were applied as exchange rates to convert Euro (ABP) and New Zealand Dollar (NZ Super) into US-Dollar.

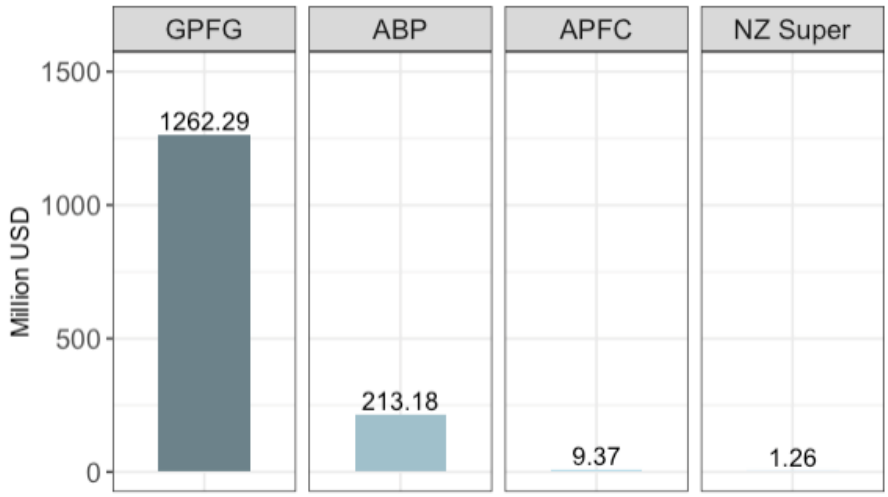

Figure 8: Total investment value (Million USD) in high-risk countries

6.2 Firm-level bribery risk analysis

This section presents the results of the analysis which examines the second hypothesis. By applying the FBRI, the firm-level bribery risk is determined for 80 sample firms from the GPFG and compared with their country-level risk through univariate regressions and pairwise t-tests.

Hypothesis II*: Within the GPFG's portfolio, firms from countries with high bribery risk are subject to high bribery risk at the firm level.*

6.2.1 Country- and firm-level bribery risk

After randomly drawing a sample of 80 companies from the GPFG portfolio as specified in section 4.2.3, the FBRI is calculated for each firm. Therefore, information is gathered about the six variables underlying the indicator as outlined in the Data section under 5.2.1. The resulting variable scores are multiplied with their respective weights. Appendix L lists all sample companies with the resulting scores of the six variables and FBRI scores, together with their respective listing country and country risk category. Bestsun Energy Co Ltd from China tops the list with an FBRI score of 68.15, while the lowest score of 19.77 is assigned to PolyNovo Ltd from Australia.

To examine the explanatory power of the listing country score for firm-level bribery risk, a simple univariate regression with the FBRI as the independent variable is applied. A linear relation is assumed for the base model, while an exponential and third-degree polynomial regression is used to test for nonlinear relations. The outcome is depicted in Figure 9, while statistics of the regression results are shown in Table 8.

In the linear model, the upward sloping regression line indicates that higher listing country risk scores generally signal higher FBRI scores in the sample. This finding is supported by its coefficient of 0.216 being significantly larger than zero at the 1% significance level. On the other hand, the high standard error of around 9.5 paired with the low R^2 term of 0.14 indicates that country risk predicts firm-specific risk with low precision. Also, the corresponding, weakly positive correlation coefficient of 0.37 underlines that the relation of country-level bribery risk and firm-level risk is generally positive but lacks precision.

The exponential regression describes a function moving nearby and almost parallel to the linear regression and even reveals the same three-digit R^2 value. Note that the stated standard error in the regression table is lower than for the other two regressions since the listing country risk scores are regressed on the log FBRI values, which are less dispersed in absolute terms. Consequently, low standard errors do not indicate enhanced precision for explaining the FBRI values for the exponential regression.

Similarly, the third-degree polynomial achieves only a slightly improved coefficient of determination of 0.15. Since the difference is marginal, this is likely to be sample-specific and does not support a polynomial relation between listing country-level bribery risk and FBRI. Generally spoken, all applied models lack precision and come along with a fairly low R^2 term, although indicating a positive relationship between country and firm-level risk.

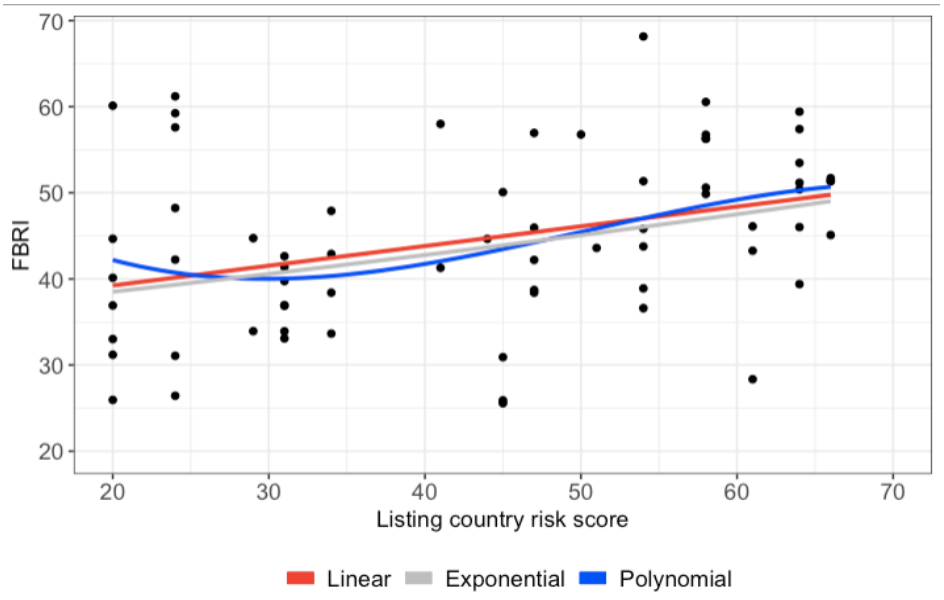

Figure 9: Scatterplot and regression models

Table 8: Results of OLS regression

	Dependent variable:		
	FBRI Linear	log(FBRI) Exponential	FBRI Polynomial
	(1)	(2)	(3)
Listing country risk score	0.216***	0.005***	
	(0.061)	(0.001)	
Listing country risk score (poly I.)			33.315***
			(9.480)
Listing country risk score (poly II.)			10.079
			(9.480)
Listing country risk score (poly III.)			−1.482
			(9.480)
Constant	35.353***	3.546***	43.876***
	(2.632)	(0.064)	(1.060)
Observations	80	80	80
R^2	0.138	0.138	0.151
Adjusted R^2	0.127	0.127	0.117
Residual Std. Error	9.428 (df = 78)	0.229 (df = 78)	9.480 (df = 76)
F Statistic	12.487*** (df = 1; 78)	12.495*** (df = 1; 78)	4.502*** (df = 3; 76)
Note:			*p<0.1; **p<0.05; ***p<0.01

To analyze the differences between firms of different country-level risk categories in more detail, average FBRI scores are calculated for the four TRACE country-level risk categories. The mean values indicated as red dots in Figure 10, consistently decrease in country-level bribery risk. Firms listed in *high* bribery risk countries have the highest mean of approximately 50, while the lowest FBRI mean of 39 prevails in the *very low* category. This is in line with the positive correlation between listing country score and FBRI as found in the linear regression.

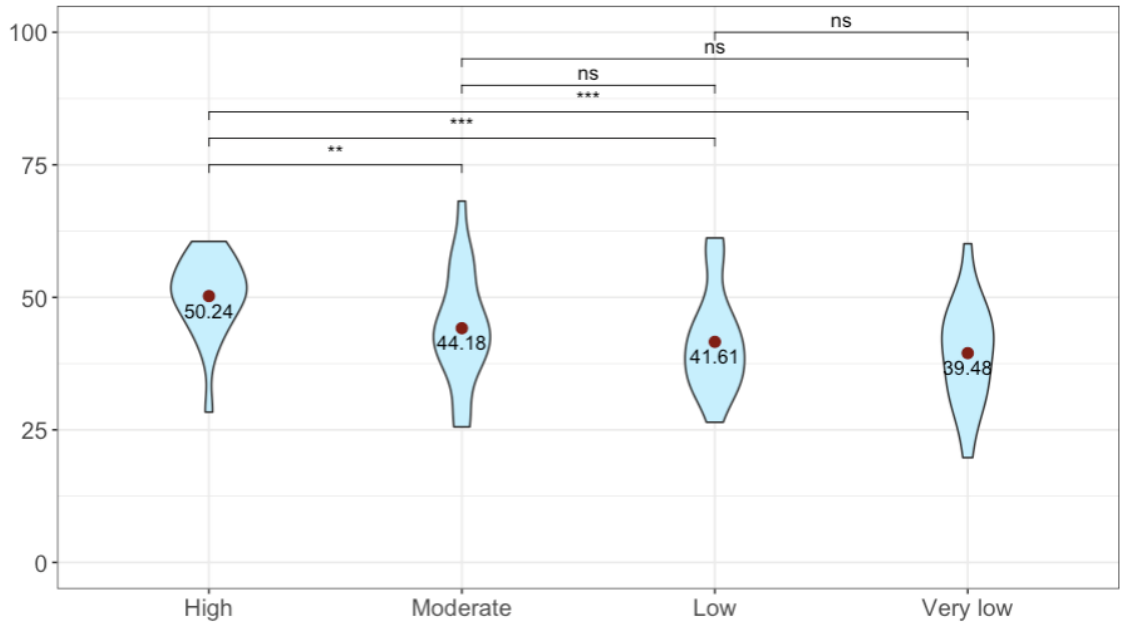

Figure 10: Violin plots depicting the distribution of the FBRI scores

An ANOVA test, estimating the differences in means across the four categories, delivers an F-test result of 4.438. Thus, the test suggests significant differences in the mean at any conventional confidence level. Since ANOVA tests fail to provide insights about the direction of deviations within the groups, the distribution of the FBRI scores within the risk categories is further analyzed.

The calculated distribution of FBRI scores for the different groups is depicted using violin plots in Figure 10. A violin plot can be considered a combination of the box plot and the kernel density plot. It is often used to compare the distribution of a given variable across different categories. Its biggest advantage is that it shows the entire distribution of the data. The shape of the violin plots in Figure 10 suggests that the differences in group means are not driven by upwards outliers among *high* country risk firms, but rather by a larger concentration of values at a moderately elevated score level of around 55. The scatter plot in Figure 9 already demonstrated that firms from lower risk countries also have high FBRI scores. However, their FBRI scores are more dispersed compared to *high* country risk firms and more firms have relatively low values.

Moreover, the average FBRI scores in the *moderate*, *low*, and *very low* categories move in a narrow range (between 39 and 44), compared to the salient 50.24 mean of *high*-country risk firms. The conducted Welch t-test supports these findings. Its results, summarized in Table 9, point out significant differences within the mean scores between firms from *high* country risk and the other three risk categories at the 5% and 1% levels. However, the differences comparing the group means between the other risk categories are not statistically significant. This points out that companies from *high*-risk countries have a systematically higher FBRI score, while the country level risk for companies from *moderate*-, *low*-, and *very low*-risk countries do not deviate significantly from the firm-specific bribery risk measured by the FBRI.

Table 9: Welch t-test results comparing the average FBRI scores between the groups

Country-level bribery risk category 1	Country-level bribery risk category 2	P-Value	Significance
High	Moderate	0.047	** (at 5% level)
High	Low	0.003	*** (at 1% level)
High	Very low	0.000	*** (at 1% level)
Moderate	Low	0.427	not significant
Moderate	Very low	0.154	not significant
Low	Very low	0.485	not significant

6.2.2 Country-level bribery risk and firm-level risk determinants

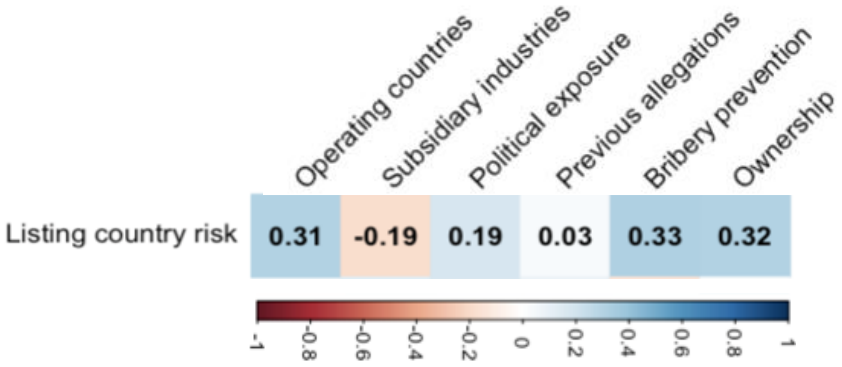

Figure 11: Correlations of country bribery risk scores and risk determinants

Some of the six variables constituting the FBRI correlate stronger with the country bribery risk score than others. Analyzing which risk determinants correlate with the country-level risk provides better insights about what the country-level risk can tell us about the firm-level risk. Figure 11 summarizes the correlation coefficients and thus the direction of the relationship between the variables and the country-level bribery score. Positive correlations are displayed in blue and negative in red colors. The correlation of all FBRI risk determinants is weak. No risk determinant seems to be accurately explained by the country-risk score when assuming a linear relation, which could be assumed for correlation coefficients of 0.5 or higher. To identify those risk determinants that led to the jump between *moderate* and *high*-country risk firms, the four risk determinants with a positive, but weak correlation coefficient are analyzed in the following paragraphs.[16]

Operating Country scores are summarized by the TRACE risk categories in Figure 12. The error bars show the standard deviation from the mean for each group. When looking at the average values, firms listed in *high*-risk countries clearly score the highest. This suggests that, within our sample, the three most risky operating countries of firms from *high*-risk listing countries are on average at higher risk than those of firms from *low*-risk listing countries. On the other hand, the standard deviation of the scores shows differences between the groups. The scores of *high*-risk countries are more clustered around the mean, while the data is more spread out for the remaining groups. Given that the Operating Country variable is weighted with 35%

[16] We also analyzed the relation between the country-level bribery risk and the Subsidiary Industries and Previous Allegations variable but could not find any meaningful results explaining the jump from *moderate* to *high*. Consequently, only the remaining four variables are presented in detail for brevity reasons.

within the FBRI risk factors, it can be concluded that it contributes to the jump of average FBRI score between *moderate*- and *high*-risk groups.

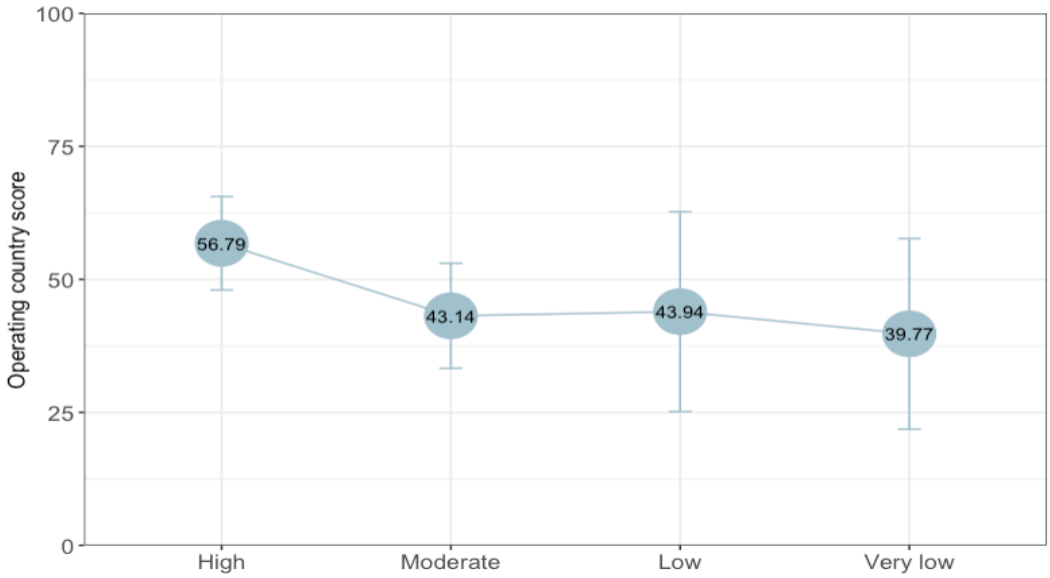

Figure 12: Average TRACE scores of the three riskiest operating countries

Political connections with the economy are an important contributor to exercise political influence in corporations, especially in emerging markets (Li, M. H. et al. 2018:176). Since emerging markets tend to have higher risk scores in corruption indices like the TRACE Matrix, it is not surprising that a positive correlation between the listing-country risk and the PEP score is identified. However, when analyzing the average number of PEPs in the supervisory and executive boards of the sample firms, firms listed in *high*-risk countries do not engage more politically exposed board members than firms from other categories (Figure 13). Although a stepwise increase in political exposure is observable from the *very low* to *moderate* category, the average PEPs in firms with *high* country risk is clearly below this value. The Italian bank Banco BPM Spa had the highest number of PEPs (16) among its board members, although listed in a country with *low* bribery risk. Therefore, in our sample, firms with *high* country-level risk are not observed to have closer ties to politics, measured by the number of PEPs on board level, than firms in the lower listing country risk categories.

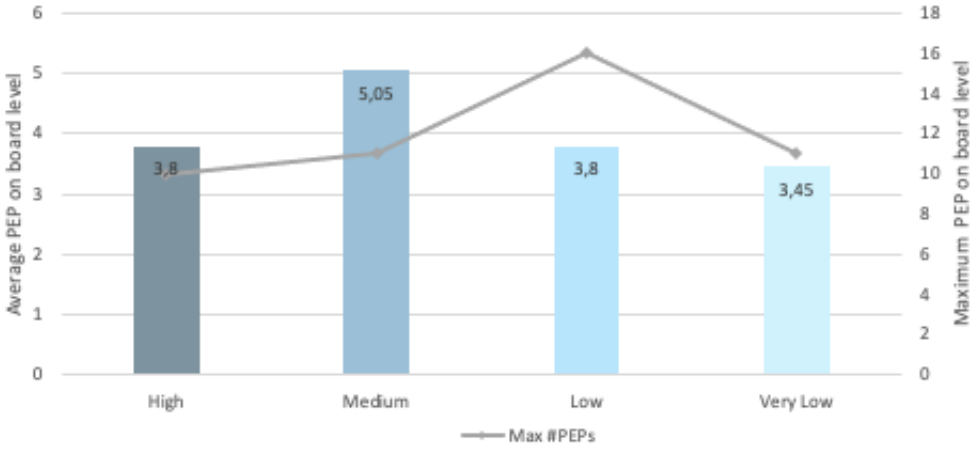

Figure 13: Political Exposure per country-level risk category

A total of six items are evaluated to assess the quality of the firms' compliance systems in place to inhibit bribery (detailed in Appendix K). Figure 14 depicts the average Bribery Prevention scores by country-level risk categories, whereas black dots designate each observation in the sample. The results imply that the scores range on a broad scale for each category, but firms from *high*-risk countries clearly have the highest average score. However, firms from *high*-risk countries with competent compliance programs can be observed, as well as firms from low-risk countries with inadequate programs.

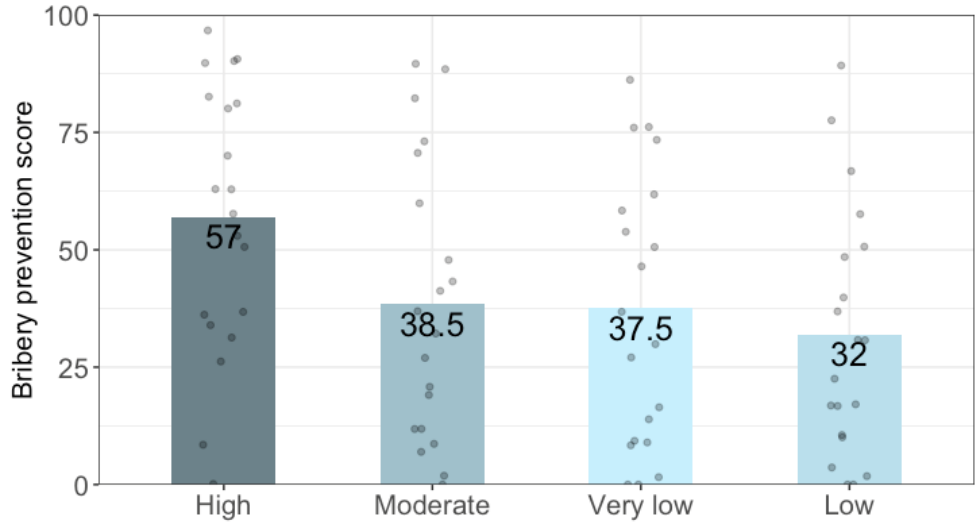

Figure 14: Average Bribery Prevention score by risk category

The underlying items used to conduct the *Bribery Prevention* score are further analyzed. Figure 15 illustrates that firms from *high*-risk countries perform worse across all surveyed items. Item 1 assesses whether a firm publicly commits to be compliant with anti-corruption laws. This adherence can be included in the Code of Ethics, Business Conduct, or sustainability and

annual reports. As opposed to companies from *very low*- and *low*-risk countries, of which 85% officially consent to anti-bribery legislation, only 45% of firms from *high*-risk countries do so. In addition, item 3 describes that merely 15% of these companies have an anti-corruption program in place for their directors and employees. Firms with robust compliance systems implemented a comprehensive anti-corruption policy with frequent training for employees and suppliers. Item 4 reveals that only 40% of the firms with *high* country risk have a policy in place on gifts and hospitality. Furthermore, a large proportion of firms listed in *high*-risk countries lack an adequate and well-functioning whistleblowing policy. Various firms provide no whistleblowing channel for their employees at all. In some cases, the channel set up to report illegal acts or unethical behavior does not provide anonymity and protection against retaliation. All in all, firms listed in *high*-risk countries report less sufficient compliance programs than firms listed in countries with lower-level bribery risk.

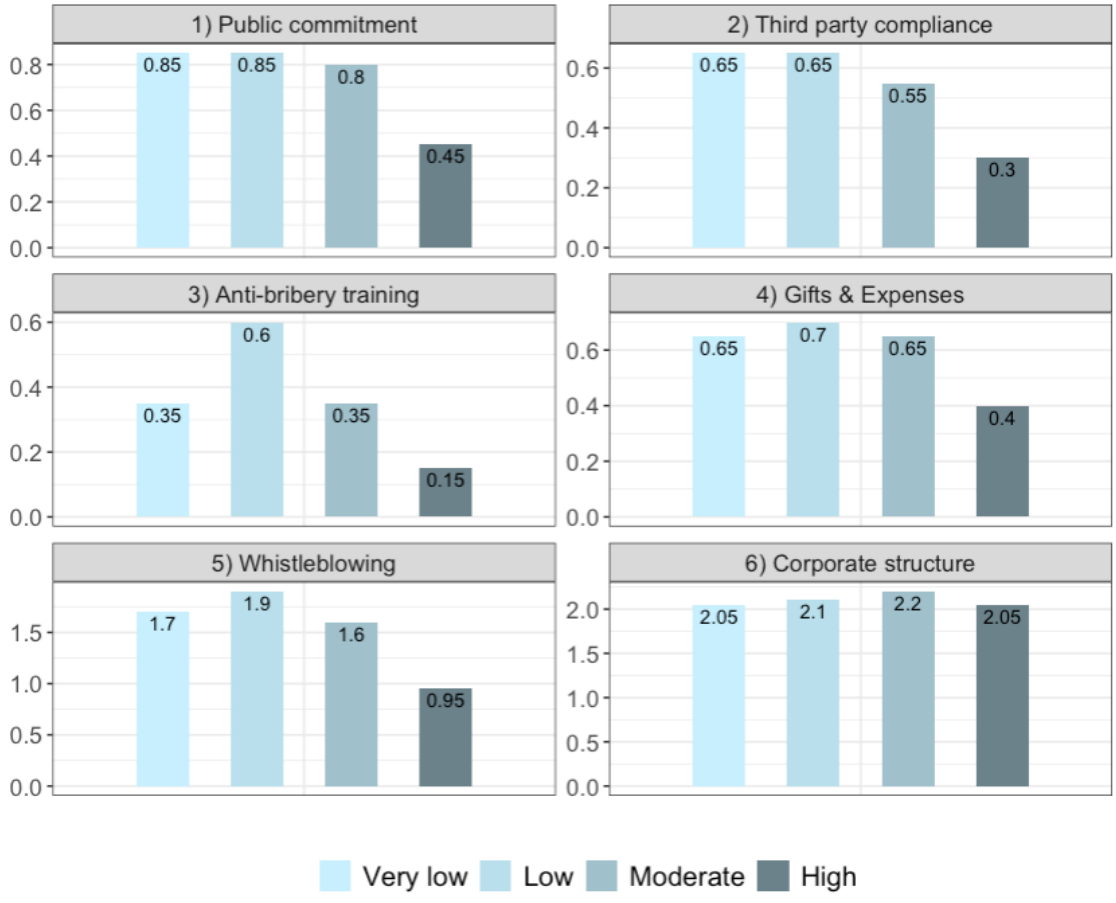

Figure 15: Underlying items for Bribery Prevention score

Information describing the *Ownership Structure* of the firms is gathered for all firms in the sample, and risk scores are assigned based on the state ownership share. Figure 16 depicts the proportional share of firms where at least 5% of the shares are owned by a government entity. Within our sample, eight out of the 20 firms (40%) listed in *high*-risk countries while seven companies from *moderate* country-risk (35%) are owned by the state. Analogously, this listed proportion is 20% for firms in *low*-risk and 5% for companies listed in *very low*-risk countries. This implies a continuous increase of state ownership with higher country-level bribery risk.

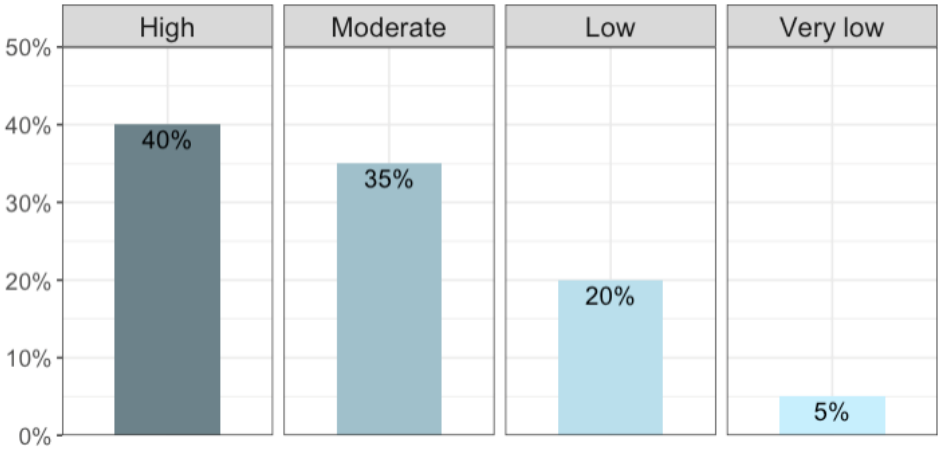

Figure 16: Proportion of firms with at least 5% state ownership

6.3 Analysis of historical returns

As the managing body of the GPFG, Norges Bank is mandated to sustainably create financial value for the Norwegian people, who are the ultimate beneficiaries of the fund. Therefore, societally relevant ESG aspects like corruption risk must be considered and balanced with financial interests when taking an investment decision. To examine if the GPFG historically benefitted from being invested in firms with elevated bribery risk, we analyze the abnormal returns of these equities with the Fama-French five-factor model. We hypothesize that equities with higher bribery risk also deliver higher abnormal returns.

***Hypothesis III*:** *Within the GPFG's portfolio, equities with high FBRI scores have higher abnormal returns than equities with low FBRI scores.*

Table 10 presents the regression result assuming GPFG weighted portfolios in columns (1) to (3) and equal-weighted portfolios in columns (4) to (6). The dependent variable for the regressions of the long-short portfolios in columns (1) and (4) is the delta return of portfolios L and H ($r_L - r_H$). In the regressions of portfolio H in column (2) and (5) the monthly excess

return of H ($r_H - r_f$) is applied as the independent variable, while the monthly excess returns of L ($r_L - r_f$) is applied as the independent variable of portfolio L in column (3) and (6).

Table 10: Fama-French five-factor plus Momentum regression

	Dependent variable:					
	$r_L - r_H$ Long L Short H	$r_H - r_f$ High	$r_L - r_f$ Low	$r_L - f_H$ Long L Short H Unw.	$r_H - r_f$ High Unw.	$r_L - r_f$ Low Unw.
	(1)	(2)	(3)	(4)	(5)	(6)
Rm-Rf	−0.03	0.74***	0.71***	0.32***	0.35***	0.67***
	(0.14)	(0.11)	(0.09)	(0.11)	(0.09)	(0.09)
SMB	0.59	−0.14	0.46	0.13	0.61**	0.74***
	(0.43)	(0.35)	(0.30)	(0.36)	(0.28)	(0.27)
HML	−0.05	0.11	0.06	−0.04	0.24	0.20
	(0.48)	(0.38)	(0.33)	(0.40)	(0.31)	(0.30)
RMW	0.53	−0.12	0.41	−0.33	0.15	−0.18
	(0.65)	(0.52)	(0.44)	(0.54)	(0.42)	(0.40)
CMA	−0.58	−0.26	−0.84*	−0.37	−0.46	−0.83**
	(0.64)	(0.52)	(0.44)	(0.53)	(0.42)	(0.40)
MOM	−0.01	0.03	0.02	0.11	0.02	0.12
	(0.23)	(0.18)	(0.16)	(0.19)	(0.15)	(0.14)
Alpha	0.002	0.74*	0.74**	0.46	0.66**	1.11***
	(0.50)	(0.40)	(0.34)	(0.41)	(0.33)	(0.31)
Observations	120	120	120	120	120	120
R^2	0.05	0.40	0.46	0.12	0.20	0.50
Adjusted R^2	−0.004	0.37	0.43	0.08	0.16	0.48
Residual Std. Error (df = 113)	4.68	3.75	3.20	3.87	3.06	2.92
F Statistic (df = 6; 113)	0.91	12.47***	15.74***	2.67**	4.80***	19.12***
Note:						*p<0.1; **p<0.05; ***p<0.01

The GPFG weighted abnormal monthly return of the long L-short H portfolio is approximately zero as shown by the alpha value in column (1). This indicates that the portfolios L and H delivered almost the same level of abnormal monthly returns from 2010 until 2019 within the GPFG portfolio. Columns (2) and (3) present the results of the regressions of both value-weighted portfolios separately. The significantly positive alpha values reveal that both portfolios have positive abnormal returns, which are significant at the 10% level (H) and to the 5% level (L). Both stand-alone portfolios contributed to the financial performance of the GPFG in the examined period with a positive abnormal return of around 0.74% per month. While column (2) does not reveal any significant concentrations of portfolio H on the Fama French factors, portfolio L has a focus on aggressive portfolios indicated by the significant negative *CMA* coefficient at the 10% significance level. This implies that equities in portfolio L tend to pursue a more aggressive investment strategy, measured by relative changes in total assets, than those of portfolio H.

Examining the regression results using the unweighted portfolio's returns as independent variables provide general insights about the financial performance of the high and low bribery risk equities since these returns are not affected by investment decisions of the GPFG. Nonetheless, the results in columns (3) to (6) are similar to the weighted results.

When assuming equal weights for the long-short portfolio in column (4), the abnormal monthly returns of portfolio L are on average 0.45% higher than those of portfolio H. However, it cannot be inferred that this difference does not appear by chance, as the alpha is not significantly larger than zero. The alpha of portfolio H (column 5) declines to 0.66% compared to the weighted model, though gained in significance as the respective standard errors lessen disproportionally. Additionally, the significant positive coefficient in the *SMB* factor suggests a focus on small-sized companies, which was avoided by the pension fund's investment strategy. On the contrary, abnormal returns of the unweighted portfolio L inclined to a remarkable level of 1.11% per month (column 6). This suggests a higher abnormal return for portfolio L than for portfolio H, which however is not statistically significant. While the load on aggressive returns prevails, a significant focus on the small portfolio is observable similarly to the equally weighted portfolio H.

7 Discussion

7.1 Discussion of hypotheses

7.1.1 Hypothesis 1

Hypothesis I: *The country-specific bribery risk exposure in the GPFG is not systematically different than of its peer sovereign wealth funds.*

All four funds have relatively low weighted bribery risk scores between 20 and 23. In our comparison of country-level bribery risk, we found two contrary results. On the one hand, our study did not suggest any substantial deviations in average country-level bribery risk for the GPFG in either direction. On the other hand, the share of equities from *high*-risk countries included in the portfolio is highest for the Norwegian fund, when considering both market value and number of the investments. Given the outstanding size of the Norwegian fund, the disparity substantiates when considering the absolute market value of these securities, aggregating to the remarkable sum of $1.3 billion.

The apparent puzzle of a low weighted average score that is contrasted by the large share of upwards outliers in the GPFG portfolio can be explained by examining the investment shares broken down by the different risk categories (Figure 17). Compared to ABP and APFC, the GPFG has a lower share of its portfolio invested in countries with *moderate* risk but a higher aggregated proportion in the *low* and *very low* categories. Since these categories account for the highest value of investments in the fund, the higher share of upwards outliers is not reflected when applying the weighted average bribery risk score.

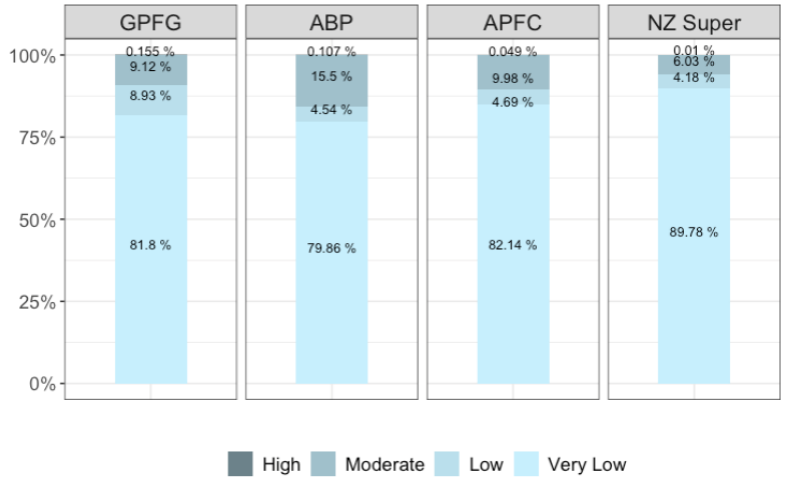

Figure 17: Portfolio split[17] by country-level bribery risk categories of the investees

[17] The proportional values of the APFC do not add up to 100%. The reason for this is the fact that some of its equities are listed in countries like the British Virgin Islands, Curaçao, and Macao. Since the TRACE Matrix does not measure the bribery risk of these countries, we were not able to assign risk categories to them.

The underlying core consideration, crucial to answering the hypothesis, is whether weighted averages or the presence of upward outliers are more meaningful for bribery risk. One may postulate that observing several *very low*-risk investments will counterbalance few *high*-risk investments. Although generally true, in settings where a single observation can have very serious consequences, average values indicating whether the event might occur are misleading. The focus on upwards outliers and identification of red flags is considered a best practice in determining bribery risk to combat corruption and ensure compliance (TRACE 2019a:1). This applies to corporate and fund managers. Consequently, since the GPFG have a systematically higher share of companies from *high* bribery countries compared to its peers, we reject the first hypothesis.

The results elaborated above raise the question of which investments cause the increased share of *high-country* risk equities in the GPFG portfolio. Evaluating the listing countries of each fund's *high*-risk investments reveals different geographic properties across the funds. Figure 18 shows the listing countries of the equities from the *high*-risk category. Looking at the GPFG, approximately 42% of its *high*-risk investments are listed in Egypt, accounting for $530 million. In addition, solely the Norwegian fund invests in Bangladesh, which is the country with the highest bribery risk score (66) in the study. Both the GPFG and ABP hold substantial shares in Egypt, Nigeria, and Vietnam. While NZ Super and APFC hold the main share of *high*-risk investments in African countries, the GPFG has invested around 95% in Asian equities. Given that the GPFG is invested in 119 equities from *high*-risk countries, it is remarkable that the absolute number of countries, where these equities are listed, is on the same level compared to the other funds.[18] A potential explanation for that is that external shocks affecting compliance are more likely to appear in these countries and its mitigation would require intensified internal monitoring capacities from the fund. These findings underpin the conclusion that the GPFG is more exposed to companies from *high* bribery risk countries, which underpins the rejection of the second hypothesis.

[18] APFG holds investments in 5, GPFG and ABP in 4, and NZ Super in 2 high-risk countries. In the APFC, Figure 18 depicts only its investments with a proportional value higher than 0.15%.

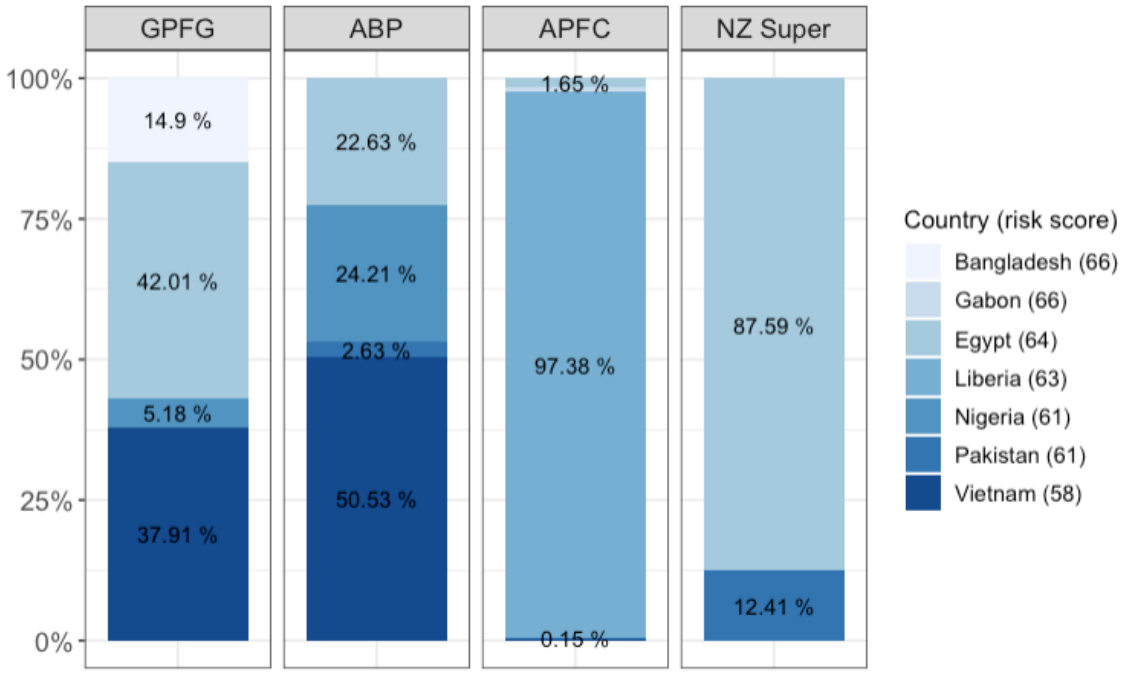

Figure 18: Proportion of investment value in high bribery risk countries

7.1.2 Hypothesis 2

***Hypothesis II**: Within the GPFG's portfolio, firms from countries with high bribery risk are subject to high bribery risk at the firm level.*

The results of the pairwise t-tests suggest that, in our sample, firms from *high*-risk countries have a significantly higher bribery risk on average than those from *moderate* or lower risk countries. However, given the huge dispersion of FBRI values across categories, the absolute differences in averages are relatively small. Hence, the accuracy of country-level bribery risk as an estimator for the actual bribery risk of a company is not sufficient for the former to work as a reliable estimator of the latter. This is also underlined by the small differences in group means between the *moderate*-, *low*-, and *very low*-risk categories in the pairwise t-test comparison and the low coefficient of determination in the linear univariate regression. Consequently, we conclude that the listing-country risk underestimates the bribery risk potential of many companies in the *low*- and *very low*-risk category. Since seven out of the ten highest FBRI scores in our sample belong to firms in *moderate* or lower risk categories (see Appendix L with overall FBRI list), we find little support for Hypothesis II and consequently reject it.

This has profound implications on the findings in the analysis under Hypothesis I. In light of our findings for testing the second hypothesis, we conclude that when considering a large

number of firms, *high*-level bribery risk implies a slightly higher average firm-specific bribery risk compared to firms from *moderate* or lower risk countries. However, for the analysis of the bribery risk of individual companies, the country-level risk is insufficient. Provided the findings of the univariate regression, we conclude that the listing country bribery score would overestimate the bribery risk of many *high* country-risk firms. Thus, we cannot generally conclude that the GPFG is at higher risk than its peer funds because of the upwards outliers, but the fact that these companies have on average a higher risk makes them an appropriate starting point for further analyses. We build upon that idea in section 7.2.1 when we discuss the implications of our findings for the fund.

The reason for the lack of precision of country-level risk for a firm's bribery risk is also highlighted by our analysis. Several of the factors, which are suggested by previous literature to be relevant determinants for the bribery risk of a firm, do not or only weakly correlate with the country bribery risk. In our sample, a weak positive correlation is indicated for the variables measuring the extent of public ownership, operating country risk, and bribery prevention initiatives. Correlations with Subsidiary Industry, Political Exposure, and Previous Allegations are slightly negative or very close to zero. Thus, we presume that the jump in FBRI scores between the *high* and *moderate* country risk firms is mainly driven by factors measured by the Operating Country and Bribery Prevention variables. We emphasize that these results only indicate (weak) correlation but do not allow any conclusion towards causation, due to potential multicollinearities to omitted variables.

A central aspect affecting the interpretation of the results is the reliability of the FBRI as an accurate measure of the actual risk exposure of a company. Conclusions inferred based on the comparison of country-level bribery risk and FBRI become obsolete if the FBRI does not capture a firm's actual risk of being involved in bribery. At its core, this problem touches upon the central limitation that corruption is concealed and its extent difficult to measure (Rose-Ackerman & Palifka 2016:14). The presumptively extensive dark figure of bribery cases and the multitude of circumstances under which corruption can occur put empirical cause-effect research of corruption risk determinants on difficult terrain. Consequently, numerous critical assumptions had to be made for the construction of the FBRI that one should be aware of.

Although the risk determinants included in the FBRI, such as political proximity and bribery prevention programs are based on concurrent academic literature, they cannot be measured directly. Hence, the applied variables can only be seen as approximations of the respective risk determinant. For instance, to estimate the quality of actual anti-bribery initiatives, the Bribery

Prevention scores are acquired by following a standardized assessment of public reporting on compliance programs. Scholars applying similar approaches like Lopatta et al. (2017:52) argue that the public and especially audited annual reports are sufficient approximations.

We acknowledge that the presumably most noisy variable in the FBRI is the Subsidiary Industry score. The lack of research quantifying bribery risk across different business sectors made it challenging to implement industry-specific risk to the FBRI. Even though the sources applied to estimate the sectoral bribery risk are frequently used publications in corruption research, they are quite outdated. However, in our opinion, including a variable for industry-level bribery risk that only approximates the real risk level is more accurate than leaving it out and neglecting risk differences across industries completely.

Assigning weights to the risk factors is also a demanding task, given their subjectivity and high impact on the final FBRI scores. Nonetheless, we believe that the allocated weights are suitable to describe the interplay between the variables included in the study. Given the time constraints, further simplification had to be made. Additional factors contributing to firm-level bribery risk, such as the inherent risk of third parties used as intermediaries, are not considered.

In conclusion, we argue that although the FBRI is not a flawless estimator of firm-level bribery risk, it captures several risk determinants of the phenomenon in a standardized format. In contrast to previous literature, it does not solely focus on public reporting or country-level risk scores but expands the analysis by several other relevant determinants. Accordingly, we argue that the FBRI is a sufficiently reliable estimator that allows deriving meaningful conclusions on a firm's bribery risk exposure. In these regards, our methodology contributes to current research by providing an expanded approach in the challenging research field of how the bribery risk of a firm can be modeled and determined.

7.1.3 Hypothesis 3

Hypothesis III: *Within the GPFG's portfolio, equities with high FBRI scores have higher abnormal returns than equities with low FBRI scores.*

By replicating the investments of the GPFG in firms with high and low bribery risk exposure, we create an ex-post analysis of their delivered financial returns. The results of the Fama-French model suggest that both portfolios H and L delivered a significantly positive abnormal return of around 0.74% per month to the Norwegian GPFG over the last ten years. The abnormal returns in the long L short H portfolio are very close to zero and nonsignificant. The results can be interpreted such that if the fund would have, at the beginning of 2010, sold its

shares of the 20 firms with the highest bribery risk in the sample and invested the amount into portfolio L, the abnormal return of the pension fund would have remained almost unchanged.[19] As a consequence, we reject Hypothesis III, as it is not supported by our findings.

The positive abnormal returns suggest that the fund indeed benefitted in the past from being invested in the 20 companies with the highest FBRI scores. Simply buying equivalent relative shares of each equity disembogue in the same result. Nevertheless, for the unweighted portfolios, we found that the 20 equities with the lowest FBRI scores provided even higher abnormal returns per month. This raises the question of whether the investments in equities of portfolio H should be replaced by those of portfolio L because the latter brings lower compliance risk to the fund's portfolio while having delivered very similar abnormal returns in our analysis.

However, one should beware of drawing hasty divestment conclusions based on the presented results, given three reasons. Firstly, the presented regression results abstract the potential diversification contribution of the analyzed firms. Albeit abnormal returns of high bribery risk companies do not exceed those of the observed low bribery risk firms, they still might substantially contribute to the GPFG's diversification, thus reducing the volatility of the total fund's returns. Secondly, as outlined in section 7.1.2, the FBRI serves as an indicator to identify bribery red flags. One cannot infer that all firms in portfolio H are corrupt and all firms in portfolio L are not. Some firms of portfolio L could be corrupt as well. A divestment decision would call for a more thorough analysis using internal data to identify whether the presented red flags by the FBRI are mitigated or not. Finally, the Fama-French model requires well-diversified portfolios to provide meaningful results. Although portfolio H (L) included equities from ten (13) different countries, including Europe, Asia, the Americas, and the Middle East, as well as eight (seven) different industries, it is unclear whether the diversification requirement is fully satisfied. Statman (2004:47) showed that the standard deviation of a portfolio where the correlation between stocks is 0.08 declines only moderately when including more than 20 firms in the portfolio. The even lower average correlation of stock returns in portfolio H (L) of 0.063 (0.057) supports that the diversification criteria might be met. Nonetheless, since

[19] Under the condition that the positions of L were increased and decreased accordingly to the positions in the GPFG, while the fictitious short positions of H were increased and decreased accordingly to the actual positions in the GPFG (i.e., when the Fund would buy additional stocks of a firm in H, the short position of that firm would increase by the same amount).

correlations of stocks historically increased over time (Bekaert et al. 2009:2593), a repetition of the analysis with a larger sample size would further validate the results.

Insights gained from the analysis are that the GPFG has financially benefitted from being invested in the high bribery risk companies included in portfolio H over the last ten years. This is indicated by the statistically significant abnormal returns. The results do neither entail that the abnormal returns of these companies were achieved through bribery, nor do they indicate that any of the firms engaged in corruption after all. It also does not provide insights about abnormal returns of other equities in the fund that have a high bribery risk exposure.

7.2 Implications for the Norwegian GPFG

7.2.1 Corruption screening process

The results of analyzing 80 firms within the GPFG showed that companies in the portfolio vary strongly with respect to existing red flags indicating potential bribery involvement. Given the large number of firms for which the FBRI score indicated red flags for investees, we suggest Norges Bank to implement a proactive screening process. In our opinion, a passive monitoring process that puts the company on an observation list, based on media reports or the recommendations proposed by the Council on Ethics is not sufficient, given the high number of investments from *high*-risk listing countries, compared to its peers.

In our empirical study, we found that, on average, firms listed in countries with *high* bribery risk, are subject to elevated firm-specific risks. However, our analysis shows that firms with *low* country-level bribery risk can also encounter elevated bribery risk. These insights imply that solely focusing on *high* bribery risk countries is misleading, however, they have on average a slightly higher bribery risk. Thus, we recommend using country risk only as a first step of the screening procedure, guiding the selection of firms for further assessment. A potential proactive screening approach could look like this: every year a concise sample of investees is selected and analyzed in detail by using an approach similar to the FBRI. The share of firms from the *high* listing country risk category should exceed its share of the total portfolio (1.6% by the end of 2019). We suggest including 5-10% of firms with *high* listing country risk. The remaining 95-90% of firms can be selected randomly from all other country risk categories.

As the FBRI only requires data that is publicly available or can be gathered through data providers, it can be calculated for and compared among several firms. Thus, the FBRI could be determined for a sample of several firms from the fund's portfolio. Following a staggered approach, those companies with particularly high FBRI scores, or scores of a similar indicator,

could be then examined in more detail, utilizing additional internal information that can be requested through the dialogue with investees. Hence, one would ensure that employee capacity is efficiently used by focusing on companies, of which the FBRI raised concern in a less time-consuming upfront screening.

Moreover, we suggest extending the expectation document (Norges Bank 2020b). The investees should be encouraged to disclose information about their ownership structure and the political exposure of their executive boards. This would increase bargaining power in cases where such information is requested from the client, as the provision of relevant anti-corruption data becomes an official prerequisite for being invested in such firms.

7.2.2 Communication with Council on Ethics

As described in section 2.2.2, NBIM's escalation process of corruption cases is often lengthy and lacks efficiency. Moreover, the communication and information exchange between Norges Bank and the Council on Ethics appears one-sided. The final decision of the bank is often made without a thorough clarification. This makes the bank's risk monitoring process appear vague and secretive. Consolidating the FBRI red flags to the screening process would help to standardize the current risk analysis procedure. It would increase the transparency of the risk detection and ease the information flow between the Bank and Council. A more detailed rationale, based on quantitative analysis, could be provided to both the Council and the public regarding the motives why a company was excluded by the fund or put on the observation list.

7.3 Limitations of the methodology

Our thesis focuses on a specific type of corrupt behavior: the engagement in public bribery. Since corruption arises in various forms with contrasting patterns, the scope of this thesis is narrowed down to research this complex phenomenon accurately. The risk that companies engage in other forms of corrupt activities like money laundering, nepotism or embezzlement is not addressed by the presented study. This affects our analysis in different aspects. For instance, given their business environment, the risk of financial institutions such as banks and insurance companies being involved in money laundering may be higher compared to bribery. Although the FBRI can be assumed to correlate with the risk of a firm being involved in other types of corruption to a certain degree, it is crucial to bear in mind that it is developed to indicate bribery risk with respect to public officials. Further, bribery taking place between firms is not directly examined. Therefore, the conclusions of our findings cannot be inferred for business-to-business bribery.

Another limiting factor for the interpretation of our results is the concealed nature and inconsistent legal definition of corruption. An act is only corruption when the law defines it as such. However, as mentioned under section 3.1, the preconditions for an act to be illegal and thereby corruption vary across jurisdictions. Both, country-level corruption risk measures like the TRACE Matrix and the FBRI assume that a common concept of bribery exists and can be measured, which does not hold in reality. Such indicators aim to measure whether a critical threshold of favor is exceeded, making a favor corrupt. However, the actual threshold of bribery deviates across jurisdictions. These factors hamper all empirical research on corruption and call for cautious interpretation of the results.

Concerning our first hypothesis, we found that publicly available information regarding the equity investment portfolio of sovereign wealth funds is vastly limited. Therefore, a selection bias could be apparent for the chosen peer funds. SWFs that disclose data on their portfolio structure demonstrate high transparency, which might signal generally profound compliance mechanisms regarding their investment decisions. Thus, relative to the whole population of SWFs, the GPFG might appear less exposed to bribery risk than it appears in the comparison with the selected peer group.

Further uncertainty affects the calculated country-level bribery risk by using the TRACE Matrix scores. The accuracy of cross-country indices is widely disputed in academic literature as they utilize perception-based data from surveys to a large extent (Chabova 2017:1880; Escresa & Picci 2017:196-97). On one hand, possible idiosyncratic variations of TRACE scores are mitigated through the conducted robustness check. On the other hand, since the TI-CPI and the WB-CoC indices are aggregated using perception-based data as well, systematic deviations through subjective biases of bribery perception cannot be eliminated. Additionally, relying on the risk categories (*very low*, *low*, *moderate*, *high*, *very high*) defined by TRACE might be misleading, as setting threshold values between countries with seemingly similar risk characteristics is largely discretionary. For example, the Slovak Republic belongs to the *low*-risk category with a risk score of 38, while Croatia falls into the *moderate* bribery risk category given its country score of 41. This issue was also addressed in the critical assessment of corruption indices published by Søreide (2006:8-9), who points out that a decreasing precision level of the TI-CPI would better account for the uncertainty of estimates.

The second hypothesis is tested by calculating the FBRI scores on a sample of 80 companies. The small sample size reduces the statistical power of our study. Since there are only 20 companies included in each risk category, the standard error of the scores is relatively high. On

the other hand, a strength of the sample size chosen is that it can be reproduced in a relatively short time. An additional limitation we face with the FBRI is that we cannot test its accuracy, given the lack of an available and precise response variable. At this point, we want to stress the meaning of the FBRI once more. It is an indicator to identify bribery red flags. It does not imply that all firms with a high score are guilty of corruption and that all firms with a low score are clean. It can be seen as a starting point for a more thorough analysis for those companies at high risk to clarify whether the discovered red flags are accurately addressed and mitigated.

The results of the analysis using the Fama-French model may be limited by the accuracy of the model. The model fails to explain a large share of the variations within historical stock returns, as shown, for instance, by Sattar (2017:123). Especially on a global level, the Fama-French model is imprecise in explaining stock return variations (Fama & French 2012:471). Nonetheless, we decided to apply the Fama-French model since it is commonly used by scholars and practitioners alike and has empirically stronger evidence than all other common asset pricing models like the CAPM (Sattar 2017). As a last remark, the small sample size of 20 companies for Portfolios H and L restricts the generalization of our findings to the whole portfolio of the GPFG. The results can only be interpreted for the two artificially created portfolios in this exercise.

8 Conclusion

8.1 Summary of findings

In this thesis, we examine the extent of bribery risk in the GPFG's portfolio and analyze whether the fund benefitted historically from being invested in companies with high bribery risk. Three separate analyses are conducted to pursue the research question. Firstly, we investigate the bribery risk exposure of the GPFG by comparing the TRACE scores of its investments' listing countries to those of a peer group of SWFs. Secondly, we evaluate whether the country-level risk is a suitable estimator for the actual bribery risk of a firm. Lastly, the historic financial returns of a sample of equities with high bribery risk in the GPFG are analyzed to assess whether the fund benefitted from being invested in these companies.

At first, the country-level exposure of the portfolio is analyzed by conducting a comparative analysis of the GPFG with three peer SWFs from New Zealand, the Netherlands, and Alaska. The country-level risk of all examined funds is modest. Applying a value-weighted average of all investment's country-level bribery risk revealed that all funds have scores ranging between 19.5 (NZ Super) and 23.7 (ABP). The GPFG and the Alaskan APFC have scores of approximately 21. Relying on the bribery risk categories defined by the TRACE Matrix, none of the funds had investments in countries from the *very high-risk* category. Further, we identify only a few holdings with *high* country risk within the surveyed portfolios. The GPFG has both the largest relative number of equities, and the highest share of its AUM invested in firms from *high*-risk countries.

Besides solely focusing on listing country risk, the FBRI is developed to identify further determinants indicative of bribery involvement of a firm. Within our sample, firms from *high* bribery risk countries following the TRACE Matrix are on average subject to significantly higher firm-specific risks than companies with lower country risks. However, differences between the *moderate*, *low*, and *very low* country risk categories are insignificant. Moreover, the regression of the country-level scores on FBRI scores reveals a very low R^2 value and high standard errors. Therefore, we conclude that the country-level risk is not an appropriate estimator of the actual bribery risk of a company.

The relation between the listing country risk and the determinants included in the FBRI is further analyzed. Certain risk factors have a stronger correlation to country-level risk than others. However, we find generally weak correlations between the variables and the listing country score, ranging from -0.19 (Subsidiary Industry risk) to 0.33 (Bribery Prevention).

However, we find that on average firms listed in countries with high bribery risk scores are more often state-owned, have slightly less effective anti-corruption systems in place, and have subsidiaries in more risky countries. Our findings do not suggest systematic differences in operating industries, political proximity, and the existence of previous bribery allegations of firms in respect to their country's bribery risk.

Hence, although the GPFG has a substantially higher share of investments from *high* bribery risk countries, we cannot infer that it is more exposed to bribery risk than its peers, given that the listing country risk is an insufficient estimator for the actual risk of the firm, measured with the FBRI. Our results suggest that a detailed comparison of bribery risk between SWFs would require a more profound analysis than simply relying on the country-level bribery risk of the equities. However, Norges Bank should be aware of the slightly but statistically significant higher bribery risk of the firms from *high* bribery risk countries and should address these issues through compliance screenings of their investees.

Regarding the third part of our analysis, the financial performance of the 20 companies with the highest and lowest FBRI scores is analyzed with the Fama-French five-factor model extended by the Momentum factor. The regression reveals that the GPFG financially benefitted from being invested in those firms from 2010 to 2019. However, we cannot establish significant differences between the high bribery risk and low bribery risk portfolio's abnormal returns.

Our findings contribute to current research by providing an approach to compare bribery risk exposure of several SWFs, which, to our knowledge, has not been conducted before. Further implications of our analysis suggest that country-level bribery should not be used as a proxy for the corruption risk of a particular firm. This applies to scholars conducting empirical research on corruption and for practitioners aiming to approximate the bribery risk of a particular firm. A respective analysis requires the consideration of further information in respect to the firm itself and its operating industries and countries. With the creation of the FBRI, we propose a standardized approach for estimating the potential risk of bribery involvement at the firm level.

8.2 Outline for prospective research

How can something unobservable be accurately measured? This question hits the most rigid constraint on empirical research of corruption. Although challenging, the opaque structure of corruption provides a vast arena of interesting research topics that ought to be examined in the

future. In the course of preparing this thesis, we faced several limitations of current research that root in the problem mentioned above, showcasing the relevance of further research.

This paper compares the GPFG with three other pension funds. Another interesting comparison could examine differences and similarities in bribery risk between pension funds and large-sized hedge funds. Similar to this thesis, the comparison of country-level bribery risk of the portfolios might be used as a starting point. However, since we showed that the country-level bribery risk is not a sufficient estimator of the firm-specific bribery risk, an indicator like the FBRI could be applied to examine the largest investments in each portfolio. Similar analyses could be conducted across the skyrocketing number of ESG labeled hedge funds. An analysis comparing corruption risk exposure in governance-oriented hedge funds with social- and environment-prioritized ones could provide interesting insights about the implications of responsible investment strategies with distinct ESG prioritizations on corruption risk.

Besides focusing exclusively on equities, another interesting exercise would be to consider fixed income investments. Such an analysis would be even more challenging than only comparing equities since the issuers of bonds and bills are not only firms but also governments, municipalities, or explicit projects like the construction of wind farms or solar plants. An analytical approach might elaborate on differences in the consequences of money flowing into corrupt firms or governments. While corrupt companies might use funds to secure a contract through bribery, corrupt governments might finance unnecessary construction projects, approved for personal gain at the expense of society. A descriptive approach could shed light on such mechanisms while an empirical study might compare funds' corruption risk in respect to the government bonds included in the portfolios.

In our analysis of industry-level bribery risk, we were confronted with a lack of current data, that would enable insights into corruption risk differences between industries. Reports that address this topic, for instance from TI and the OECD, are already several years old. Although the WB Enterprise Survey provides a large data set of experience-based data about bribery of different firms, we could not apply it to analyze differences in experiences across industries as the provided industry code is not sufficiently granular to distinguish, for instance, between defense and other heavy equipment manufacturers. Reporting a four-digit SIC or six-digit NAICS code of the responding firms would increase the value of this dataset for research on corruption risk at the industry level. Another interesting research field related to industry-level bribery risk, which is currently insufficiently covered, is the relation of industry and country-level risk. The industry risk and country-level risk in the FBRI are assumed to contribute to a

firm's bribery risk exposure independent of each other. However, firms operating in high-risk industries and high-risk countries might face disproportionally higher corruption risk than firms in *high*-risk industries in *low*-risk countries.

Creating a measure that estimates the bribery risk of companies by considering several red flags is an integral part of the thesis at hand. The literature review showed that previous approaches estimating the bribery risk at the firm level applied either the country-level risk factor, which we found insufficient or the reporting about anti-corruption programs and compliance efforts. As depicted by the FBRI, it is possible to create indicators that reflect several aspects of bribery risk. However, current research about how such an indicator could be developed is limited despite the clear value that such a measure has for both academics and practitioners. Practitioners could utilize a respective indicator by applying it as a preliminary identification tool for bribery red flags. Empirical studies may benefit from an estimator of firm-level bribery risk, for analyzing the relations between corruption risk and other firm characteristics like management quality, financial performance, or even carbon emissions. The increasing availability of large ESG data provides vast opportunities for the academic field of corruption and research will have to play a crucial role in promoting its utilization to shed more light on the causes and effects of bribery at the firm level.

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10 Appendix

Appendix A: Risk category thresholds defined by the TRACE Matrix

Risk level	Overall bribery risk score	Example countries (scores)
Very low	1 < risk score < 22	Denmark (1), United States (20)
Low	23 < risk score < 38	France (24), Slovak Republic (38)
Moderate	39 < risk score < 56	Croatia (41), Russian Federation (54)
High	57 < risk score < 74	Vietnam (58), Dem. Rep. of Congo (72)
Very high	75 < risk score < 100	Somalia (80), North Korea (93)

Appendix B: Industry classification with industry bribery risk scores

Industries	Bribey Risk Rank	Industry Bribery Risk Score
Construction	1	100.00
Defense	2	90.91
Transportation	3	81.82
Utilities	4	72.73
Extraction	5	63.64
Human health	6	54.55
Telecommunication	7	45.45
Financial services	8	36.36
Service Industries	9	27.27
Agriculture, Forestry, And Fishing	10	18.18
Wholesale and retail	11	9.09
Manufacturing	12	0.00

Appendix C: Bribery Prevention score checklist with scores

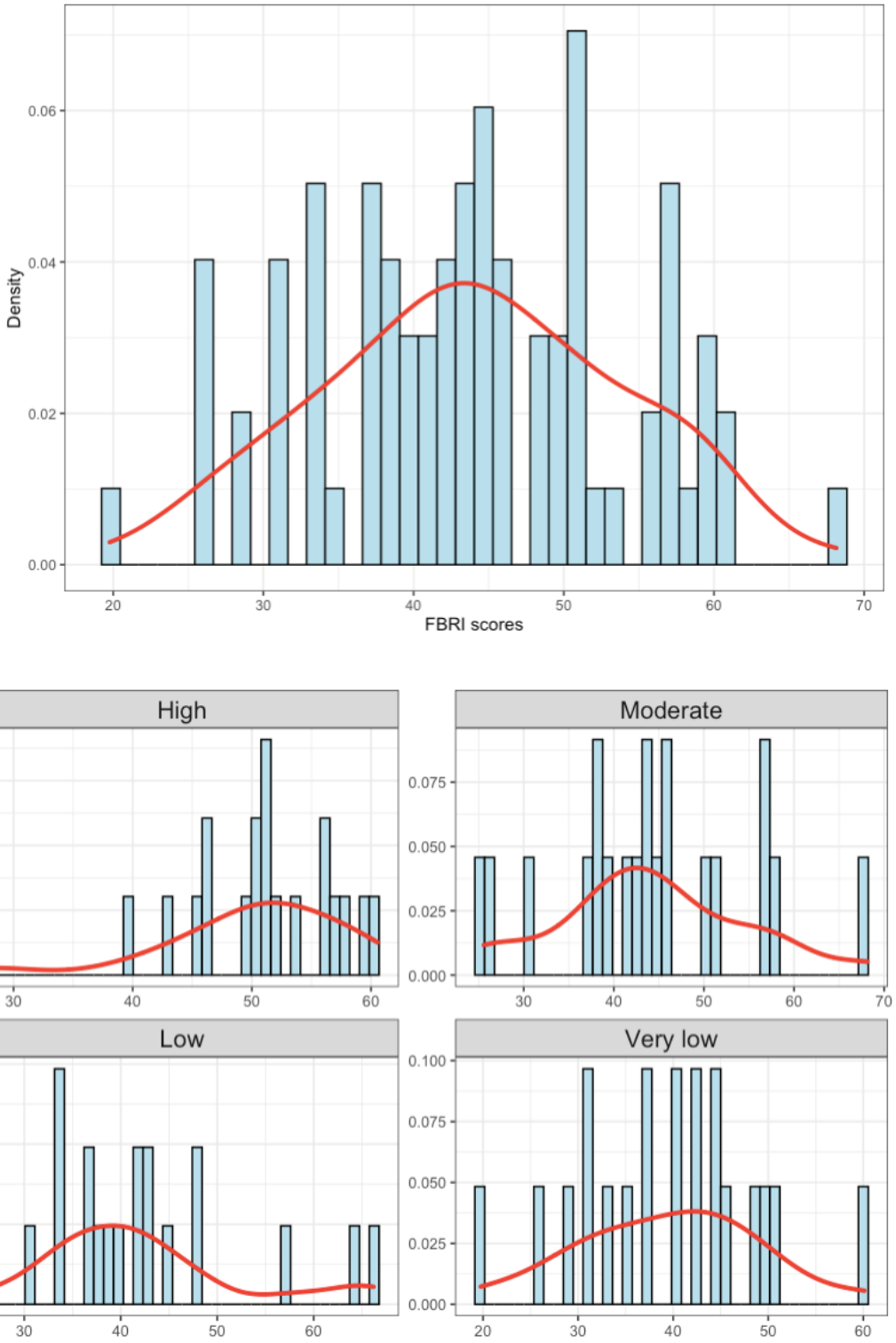
Item number	Description	Scoring
Item 1	Does the company publicly commit to be in compliance with all relevant laws, including anti-corruption laws?	0- No 1 - Yes
Item 2	Does the company's anti-corruption programme apply to non-controlled persons or entities that provide goods or services under contract (for example: contractors, subcontractors?)	0- No 1 - Yes
Item 3	Does the company have in place an anti-corruption training programme for its employees and directors?	0- No 1 - Yes
Item 4	Does the company have a policy on gifts, hospitality and expenses?	0- No 1 - Yes
Item 5	Does the company provide a channel through which employees can report suspected breaches of anti-corruption policies, and does the channel allow for confidential and/or anonymous reporting?	0 - No whistleblower channel 1 - There is a whistleblower channel 2 - The channel is anonym / confidental 3 - The channel is anyonym with no reprisal
Item 6	Does the company disclose percentages owned in each of its fully consolidated subsidiaries?	0 - No disclosure 1 - Main subsidiaries without percentage shares 2 - Main subsidiaries with percentage shares 3 - Exhaustive list is provided with percentage shares

Appendix D: Overview of 80 sample companies

	Moderate Industry Risk		Increased Industry Risk	
Country risk	Country	Name	Country	Name
Very low	United States	Rapid7 Inc	United States	ResMed Inc
Very low	Japan	Ateam Inc	Japan	Ono Pharmaceutical Co Ltd
Very low	United States	Kellogg Co	Japan	Shin Nippon Air Technologies Co Ltd
Very low	Hong Kong	Tingyi Cayman Islands Holding Corp	Australia	PolyNovo Ltd
Very low	Germany	Leoni AG	United States	Syneos Health Inc
Very low	United States	Sonoco Products Co	Japan	Sanyo Electric Railway Co Ltd
Very low	Japan	Jamco Corp	Japan	Maruwa Unyu Kikan Co Ltd
Very low	Canada	Gildan Activewear Inc	Taiwan	Forest Water Environment Engineering Co Ltd
Very low	Japan	GCA Corp	United States	Replimune Group Inc
Very low	United States	East West Bancorp Inc	Australia	Iluka Resources Ltd
Low	Chile	Embotelladora Andina SA	Poland	Polenergia SA
Low	Italy	COIMA RES SpA	Chile	Enel Americas SA
Low	Italy	Banco BPM SpA	France	Vinci SA
Low	France	LVMH Moet Hennessy Louis Vuitton SE	Spain	Naturgy Energy Group SA
Low	France	Wallix Group	Poland	Ryvu Therapeutics SA
Low	France	Exel Industries	France	Genfit
Low	Israel	Ram-On Investments & Holdings 1999 Ltd	Italy	Recordati SpA
Low	Italy	OVS SpA	France	Ipsen SA
Low	Italy	Antares Vision SpA	Italy	Iren SpA
Low	Poland	Alior Bank SA	Poland	Netia SA
Moderate	India	Bajaj Holdings & Investment Ltd	Philippines	Cosco Capital Inc
Moderate	Brazil	Azul SA	India	GTPL Hathway Ltd
Moderate	India	Kajaria Ceramics Ltd	China	Bestsun Energy Co Ltd
Moderate	China	Fu Shou Yuan International Group Ltd	Qatar	Qatar Electricity & Water Co QSC
Moderate	China	Shoucheng Holdings Ltd	Brazil	Telefonica Brasil SA
Moderate	South Africa	AVI Ltd	China	Huadong Medicine Co Ltd
Moderate	India	Borosil Glass Works Ltd	Brazil	Omega Geracao SA
Moderate	China	Sunac China Holdings Ltd	South Africa	AngloGold Ashanti Ltd
Moderate	China	Suning Universal Co Ltd	Thailand	Thai Airways International PCL
Moderate	Brazil	Via Varejo SA	Indonesia	Elnusa Tbk PT
High	Nigeria	Access Bank PLC	Vietnam	Vietnam National Petroleum Group
High	Egypt	Oriental Weavers	Vietnam	Petrovietnam Transportation Corp
High	Vietnam	Khang Dien House Trading and Investment JSC	Bangladesh	Beximco Pharmaceuticals Ltd
High	Nigeria	Guinness Nigeria PLC	Vietnam	Hoa Phat Group JSC
High	Nigeria	Stanbic IBTC Holdings PLC	Egypt	Orascom Construction PLC
High	Vietnam	JSC Bank For Foreign Trade Of Vietnam	Bangladesh	Summit Power Ltd
High	Bangladesh	BBS Cables Ltd	Nigeria	MTN Nigeria Communications PLC
High	Egypt	Electro Cable Egypt	Egypt	Minapharm Pharmaceuticals
High	Egypt	Egyptian Financial & Industrial Co	Egypt	Integrated Diagnostics Holdings PLC
High	Bangladesh	Berger Paints Bangladesh Ltd	Egypt	Telecom Egypt Co

Appendix E: Testing the assumptions of parametric data

1) Normality assumption



Interpretation: The p-value of the Shapiro-Wilk normality tests are higher than 0.05 for all risk categories. Thus, the null hypothesis cannot be rejected, meaning that the sample is likely normally distributed.

Variable	Country risk	Statistic	p-value	Method
FBRI	High	0.91	0.057	Shapiro-Wilk normality test
FBRI	Moderate	0.97	0.774	Shapiro-Wilk normality test
FBRI	Low	0.91	0.055	Shapiro-Wilk normality test
FBRI	Very low	0.99	1.000	Shapiro-Wilk normality test

2) Homogeneity of variances

```
Levene's Test for Homogeneity of Variance (center = mean)
      Df F value Pr(>F)
group  3  0.7534 0.5237
      76
```

Interpretation: Since the p-value of the conducted Levene Test (0.52) is higher than 0.05, the null hypothesis of equal population variances cannot be rejected. The variables do not violate the homogeneity of variance assumption needed for the ANOVA.

Appendix F: Top 3 riskiest operating countries

ID	Company Name	Operating country 1	Risk score 1	Operating country 2	Risk score 2	Operating country 3	Risk score 3	**Operating country score**
1	Access Bank PLC	Burundi	74	Dem. Rep. of the Congo	72	Guinea	61	69
2	Alior Bank SA	Poland	34	NA	NA	NA	NA	34
3	AngloGold Ashanti Ltd	Republic of the Congo (Brazzaville)	72	Zimbabwe	62	Guinea	61	65
4	Antares Vision SpA	Russian Federation	54	Brazil	47	India	45	48,67
5	Ateam Inc	Vietnam	58	Japan	19	NA	NA	38,5
6	AVI Ltd	Nigeria	61	Zambia	59	South Africa	41	53,67
7	Azul SA	Brazil	47	Uruguay	27	United States	20	31,33
8	Bajaj Holdings & Investment Ltd	India	45	Indonesia	44	NA	NA	44,5
9	Banco BPM SpA	Italy	31	Switzerland	14	United Kingdom	14	19,67
10	BBS Cables	Bangladesh	NA	NA	NA	NA	NA	66
11	Berger Paints Bangladesh Ltd	Bangladesh	66	NA	NA	NA	NA	66
12	Bestsun Energy Co Ltd	China	54	NA	NA	NA	NA	54
13	Beximco Pharmaceuticals Ltd	Bangladesh	66	Malaysia	38	NA	NA	52
14	Borosil Glass Works Ltd	India	45	United Arab Emirates	33	NA	NA	39
15	COIMA RES SpA	Italy	31	Luxembourg	19	NA	NA	25
16	Cosco Capital Inc	Philippines	51	NA	NA	NA	NA	51
17	East West Bancorp Inc	China	54	United States	20	NA	NA	37
18	Egyptian Financial & Industrial Co	Egypt	64	NA	NA	NA	NA	64
19	Electro Cable Egypt	Egypt	64	United Arab Emirates	33	NA	NA	48,5
20	Elnusa Tbk PT	Indonesia	44	NA	NA	NA	NA	44
21	Embotelladora Andina SA	Paraguay	52	Brazil	47	Argentina	44	47,67
22	Enel Americas SA	Brazil	47	Colombia	45	Peru	45	45,67
23	Exel Industries	Russian Federation	54	Romania	44	France	24	40,67
24	Forest Water Environment Engineering Co Ltd	Samoa	50	Hong Kong	19	Taiwan	19	29,33
25	Fu Shou Yuan International Group Ltd	China	54	Hong Kong	19	NA	NA	36,5
26	GCA Corp	Vietnam	58	China	54	India	45	52,33
27	Genfit	France	24	United States	20	NA	NA	22
28	Gildan Activewear Inc	Honduras	59	Barbados	37	United States	20	38,67
29	GTPL Hathway Ltd	India	45	NA	NA	NA	NA	45
30	Guinness Nigeria PLC	Nigeria	61	NA	NA	NA	NA	61
31	Hoa Phat Group JSC	Vietnam	58	NA	NA	NA	NA	58
32	Huadong Medicine Co Ltd	China	54	United States	20	Hong Kong	19	31
33	Iluka Resources Ltd	Sierra Leone	60	China	54	Tanzania	54	56
34	INTEGRATED DIAGNOSTICS HOLDINGS PLC	Sudan	66	Egypt	64	Jordan	45	58,33
35	Ipsen SA	North Korea	93	Algeria	65	China	54	70,67
36	Iren SpA	Honduras	59	Italy	31	NA	NA	45
37	Jamco Corp	Philippines	51	United States	20	Japan	19	30
38	JSC Bank For Foreign Trade Of Vietnam	Laos	73	Vietnam	58	United States	20	50,33
39	Kajaria Ceramics Ltd	Kazakhstan	53	India	45	United Kingdom	14	37,33
40	Kellogg Co	North Korea	93	Venezuela	82	Egypt	64	79,67
41	Khang Dien House Trading and Investment JSC	Vietnam	58	NA	NA	NA	NA	58
42	Leoni AG	Egypt	64	China	54	Russian Federation	54	57,33
43	LVMH Moet Hennessy Louis Vuitton SE	North Korea	93	Cambodia	80	Laos	73	82
44	Maruwa Unyu Kikan Co Ltd	Japan	19	NA	NA	NA	NA	19
45	Minapharm Pharmaceuticals	Egypt	64	Germany	14	NA	NA	39
46	MTN Nigeria Communications PLC	Nigeria	61	NA	NA	NA	NA	61
47	Naturgy Energy Group SA	Venezuela	82	Nicaragua	67	Egypt	64	71
48	Netia SA	Poland	34	NA	NA	NA	NA	34
49	Omega Geracao SA	Brazil	47	NA	NA	NA	NA	47
50	Ono Pharmaceutical Co Ltd	North Korea	93	South Korea	20	United States	20	44,33
51	Orascom Construction PLC	Algeria	65	Egypt	64	Nigeria	61	63,33
52	Oriental Weavers	Egypt	64	China	54	United States	20	46
53	OVS SpA	China	54	Serbia	50	India	45	49,67
54	Petrovietnam Transportation Corp	Vietnam	58	Malaysia	38	France	24	40
55	Polenergia SA	Poland	34	NA	NA	NA	NA	34
56	PolyNovo Ltd	United States	20	Australia	15	New Zealand	8	14,33
57	Qatar Electricity & Water Co QSC	Qatar	50	Oman	48	NA	NA	49
58	Ram-On Investments & Holdings 1999 Ltd	China	54	Israel	31	United States	20	35
59	Rapid7 Inc	Israel	31	United States	20	Japan	19	23,33
60	Recordati SpA	Russian Federation	54	Turkey	52	Mexico	49	51,67
61	Replimune Group Inc	United States	20	United Kingdom	14	NA	NA	17
62	ResMed Inc	North Korea	93	China	54	Mexico	49	65,33
63	Ryvu Therapeutics SA	Poland	34	United Kingdom	14	NA	NA	24
64	Sanyo Electric Railway Co Ltd	Japan	19	NA	NA	NA	NA	19
65	Shin Nippon Air Technologies Co Ltd	China	54	Sri Lanka	47	Japan	19	40
66	Shoucheng Holdings Ltd	China	54	Samoa	50	Hong Kong	19	41
67	Sonoco Products Co	Venezuela	82	China	54	Russian Federation	54	63,33
68	Stanbic IBTC Holdings PLC	Nigeria	61	NA	NA	NA	NA	61
69	Summit Power Ltd	Bangladesh	66	NA	NA	NA	NA	66
70	Sunac China Holdings Ltd	China	54	Hong Kong	19	NA	NA	36,5
71	Suning Universal Co Ltd	China	54	NA	NA	NA	NA	54
72	Syneos Health Inc	Lebanon	59	France	24	United States	20	34,33
73	Telecom Egypt Co	Algeria	65	Egypt	64	Morocco	48	59
74	Telefonica Brasil SA	Brazil	47	Netherlands	11	NA	NA	29
75	Thai Airways International PCL	Thailand	47	United States	20	Germany	14	27
76	Tingyi Cayman Islands Holding Corp	China	54	Hong Kong	19	NA	NA	36,5
77	Via Varejo SA	Brazil	47	NA	NA	NA	NA	47
78	Vietnam National Petroleum Group	Laos	73	Vietnam	58	Singapore	17	49,33
79	Vinci SA	Cambodia	80	Chad	75	Dem. Rep. of the Congo	72	75,67
80	Wallix Group	France	24	Spain	24	United States	20	22,67

Appendix G: Top 3 riskiest subsidiary industries

	Name	SIC_code1	SIC1_description	Risk_score1	SIC_code2	SIC2_description	Risk_score2	SIC_code3	SIC3_description	Risk_score3	**subsidiary_score**
1	Access Bank PLC	602	Financial services	37	737	Service Industries	28	NA	NA	NA	32,5
2	Alior Bank SA	614	Financial services	37	737	Service Industries	28	594	Wholesale and retail	10	25
3	AngloGold Ashanti Ltd	353	Construction	100	104	Extraction	64	806	Human health	55	73
4	Antares Vision SpA	356	Defense	91	737	Service Industries	28	369	Manufacturing	0	39,67
5	Ateam Inc	671	Financial services	37	899	Service Industries	28	355	Manufacturing	0	21,67
6	AVI Ltd	122	Extraction	64	283	Human health	55	672	Financial services	37	52
7	Azul SA	451	Transportation	82	672	Financial services	37	738	Service Industries	28	49
8	Bajaj Holdings & Investment Ltd	491	Utilities	73	615	Financial services	37	829	Service Industries	28	46
9	Banco BPM SpA	152	Construction	100	422	Transportation	82	138	Extraction	64	82
10	Berger Paints Bangladesh Ltd	325	Manufacturing	0	NA	NA	NA	NA	NA	NA	0
11	Bestsun Energy Co Ltd	179	Construction	100	421	Transportation	82	492	Utilities	73	85
12	Beximco Pharmaceuticals Ltd	283	Human health	55	621	Financial services	37	NA	NA	NA	46
13	Borosil Glass Works Ltd	508	Wholesale and retail	10	322	Manufacturing	0	NA	NA	NA	5
14	COIMA RES SpA	153	Construction	100	653	Financial services	37	NA	NA	NA	68,5
15	Cosco Capital Inc	131	Extraction	64	679	Financial services	37	874	Service Industries	28	43
16	East West Bancorp Inc	602	Financial services	37	NA	NA	NA	NA	NA	NA	37
17	Egyptian Financial & Industrial Co	289	Manufacturing	0	NA	NA	NA	NA	NA	NA	0
18	Electro Cable Egypt	401	Transportation	82	508	Wholesale and retail	10	NA	NA	NA	46
19	Elnusa Tbk PT	177	Construction	100	131	Extraction	64	672	Financial services	37	67
20	Embotelladora Andina SA	401	Transportation	82	672	Financial services	37	701	Service Industries	28	49
21	Enel Americas SA	162	Construction	100	449	Transportation	82	491	Utilities	73	85
22	Exel Industries	174	Construction	100	356	Defense	91	653	Financial services	37	76
23	Forest Water Environment Engineering Co Ltd	495	Utilities	73	671	Financial services	37	738	Service Industries	28	46
24	Fu Shou Yuan International Group Ltd	671	Financial services	37	726	Service Industries	28	519	Wholesale and retail	10	25
25	GCA Corp	628	Financial services	37	874	Service Industries	28	NA	NA	NA	32,5
26	Genfit	283	Human health	55	873	Service Industries	28	NA	NA	NA	41,5
27	Gildan Activewear Inc	621	Financial services	37	738	Service Industries	28	226	Manufacturing	0	21,67
28	GTPL Hathway Ltd	483	Telecommunication	46	737	Service Industries	28	366	Manufacturing	0	24,67
29	Guinness Nigeria PLC	208	Manufacturing	0	NA	NA	NA	NA	NA	NA	0
30	Hoa Phat Group JSC	179	Construction	100	108	Extraction	64	651	Financial services	37	67
31	Huadong Medicine Co Ltd	421	Transportation	82	809	Human health	55	615	Financial services	37	58
32	Iluka Resources Ltd	152	Construction	100	472	Transportation	82	109	Extraction	64	82
33	INTEGRATED DIAGNOSTICS HOLDINGS PLC	384	Human health	55	NA	NA	NA	NA	NA	NA	55
34	Ipsen SA	283	Human health	55	631	Financial services	37	873	Service Industries	28	40
35	Iren SpA	171	Construction	100	495	Utilities	73	671	Financial services	37	70
36	Jamco Corp	348	Defense	91	421	Transportation	82	762	Service Industries	28	67
37	JSC Bank For Foreign Trade Of Vietnam	602	Financial services	37	NA	NA	NA	NA	NA	NA	37
38	Kajaria Ceramics Ltd	738	Service Industries	28	327	Manufacturing	0	NA	NA	NA	14
39	Kellogg Co	632	Financial services	37	737	Service Industries	28	509	Wholesale and retail	10	25
40	Khang Dien House Trading and Investment JSC	152	Construction	100	679	Financial services	37	083	Agriculture, Forestry, And Fishing	19	52
41	Leoni AG	173	Construction	100	362	Defense	91	671	Financial services	37	76
42	LVMH Moet Hennessy Louis Vuitton SE	152	Construction	100	472	Transportation	82	735	Extraction	64	82
43	Maruwa Unyu Kikan Co Ltd	421	Transportation	82	641	Financial services	37	738	Service Industries	28	49
44	Minapharm Pharmaceuticals	283	Human health	55	873	Service Industries	28	512	Wholesale and retail	10	31
45	MTN Nigeria Communications PLC	489	Telecommunication	46	616	Financial services	37	729	Service Industries	28	37
46	Naturgy Energy Group SA	179	Construction	100	441	Transportation	82	493	Utilities	73	85
47	Netia SA	162	Construction	100	489	Telecommunication	46	737	Service Industries	28	58
48	Omega Geracao SA	162	Construction	100	491	Utilities	73	671	Financial services	37	70
49	Ono Pharmaceutical Co Ltd	283	Human health	55	672	Financial services	37	738	Service Industries	28	40
50	Orascom Construction PLC	162	Construction	100	422	Transportation	82	491	Utilities	73	85
51	Oriental Weavers	602	Financial services	37	523	Wholesale and retail	10	227	Manufacturing	0	15,67
52	OVS SpA	152	Construction	100	478	Transportation	82	653	Financial services	37	73
53	Petrovietnam Transportation Corp	461	Transportation	82	138	Extraction	64	671	Financial services	37	61
54	Polenergia SA	491	Utilities	73	653	Financial services	37	874	Service Industries	28	46
55	PolyNovo Ltd	384	Human health	55	873	Service Industries	28	591	Wholesale and retail	10	31
56	Qatar Electricity & Water Co QSC	491	Utilities	73	874	Service Industries	28	NA	NA	NA	50,5
57	Ram-On Investments & Holdings 1999 Ltd	762	Service Industries	28	509	Wholesale and retail	10	308	Manufacturing	0	12,67
58	Rapid7 Inc	179	Construction	100	671	Financial services	37	737	Service Industries	28	55
59	Recordati SpA	283	Human health	55	651	Financial services	37	738	Service Industries	28	40
60	Replimune Group Inc	873	Service Industries	28	NA	NA	NA	NA	NA	NA	28
61	ResMed Inc	478	Transportation	82	384	Human health	55	489	Telecommunication	46	61
62	Ryvu Therapeutics SA	873	Service Industries	28	NA	NA	NA	NA	NA	NA	28
63	Sanyo Electric Railway Co Ltd	162	Construction	100	421	Transportation	82	653	Financial services	37	73
64	Shin Nippon Air Technologies Co Ltd	171	Construction	100	653	Financial services	37	762	Service Industries	28	55
65	Shoucheng Holdings Ltd	449	Transportation	82	679	Financial services	37	874	Service Industries	28	49
66	Sonoco Products Co	356	Defense	91	478	Transportation	82	671	Financial services	37	70
67	Stanbic IBTC Holdings PLC	615	Financial services	37	NA	NA	NA	NA	NA	NA	37
68	Summit Power Ltd	491	Utilities	73	NA	NA	NA	NA	NA	NA	73
69	Sunac China Holdings Ltd	154	Construction	100	653	Financial services	37	738	Service Industries	28	55
70	Suning Universal Co Ltd	653	Financial services	37	738	Service Industries	28	324	Manufacturing	0	21,67
71	Syneos Health Inc	809	Human health	55	671	Financial services	37	874	Service Industries	28	40
72	Telecom Egypt Co	489	Telecommunication	46	357	Manufacturing	0	NA	NA	NA	23
73	Telefonica Brasil SA	478	Transportation	82	489	Telecommunication	46	615	Financial services	37	55
74	Thai Airways International PCL	451	Transportation	82	598	Extraction	64	829	Service Industries	28	58
75	Tingyi Cayman Islands Holding Corp	609	Financial services	37	738	Service Industries	28	514	Wholesale and retail	10	25
76	Via Varejo SA	421	Transportation	82	615	Financial services	37	738	Service Industries	28	49
77	Vietnam National Petroleum Group	161	Construction	100	441	Transportation	82	517	Extraction	64	82
78	Vinci SA	152	Construction	100	458	Transportation	82	493	Utilities	73	85
79	Wallix Group	737	Service Industries	28	274	Manufacturing	0	NA	NA	NA	14

Note: BBS Cables has no subsidiaries, so it is not included in the above list.

Appendix H: Overview of all companies with state ownership in the sample

Name	Publicly owned share	Country
Orascom Construction PLC	84.65%	Dubai
Vietnam National Petroleum Group	82.79%	Vietnam
Telecom Egypt Co	80.00%	Egypt
JSC Bank For Foreign Trade Of Vietnam	74.80%	Vietnam
Thai Airways International PCL	57.53%	Thailand
Qatar Electricity & Water Co QSC	54.54%	Qatar
Egyptian Financial & Industrial Co	51.19%	Egypt
Elnusa Tbk PT	51.10%	Indonesia
Petrovietnam Transportation Corp	51.00%	Vietnam
COIMA RES SpA	40.13%	Qatar
Iren SpA	18.53%	Commune di Torino
Polenergia SA	15.99%	China
AVI Ltd	15.04%	South Africa
Stanbic IBTC Holdings PLC	13.94%	South Africa
Shoucheng Holdings Ltd	12.60%	China
AngloGold Ashanti Ltd	10.41%	South Africa
Ram-On Investments & Holdings 1999 Ltd	6.00%	India
Gildan Activewear Inc	5.96%	Quebec
Oriental Weavers	5.00%	Egypt

Appendix I: Overview of number of PEPs on board level for the 80 sample companies

Company Name	PEPs in Board of Directors	PEP score
Rapid7 Inc	3	50
Ateam Inc	5	75
Kellogg Co	0	0
Tingyi Cayman Islands Holding Corp	5	75
Leoni AG	9	100
Sonoco Products Co	1	50
Jamco Corp	0	0
Gildan Activewear Inc	8	100
GCA Corp	8	100
East West Bancorp Inc	1	50
Embotelladora Andina SA	3	50
COIMA RES SpA	0	0
Banco BPM SpA	16	100
LVMH Moet Hennessy Louis Vuitton SE	12	100
Wallix Group	1	50
Exel Industries	1	50
Ram-On Investments & Holdings 1999 Ltd	0	0
OVS SpA	1	50
Antares Vision SpA	0	0
Alior Bank SA	5	75
Bajaj Holdings & Investment Ltd	7	100
Azul SA	4	75
Kajaria Ceramics Ltd	3	50
Fu Shou Yuan International Group Ltd	7	100
Shoucheng Holdings Ltd	5	75
AVI Ltd	3	50
Borosil Glass Works Ltd	2	50
Sunac China Holdings Ltd	8	100
Suning Universal Co Ltd	4	75
Via Varejo SA	4	75
Access Bank PLC	3	50
Oriental Weavers	4	75
Khang Dien House Trading and Investment JSC	1	50
Guinness Nigeria PLC	2	50
Stanbic IBTC Holdings PLC	1	50
JSC Bank For Foreign Trade Of Vietnam	9	100
BBS Cables Ltd	3	50
Electro Cable Egypt	2	50
Egyptian Financial & Industrial Co	1	50
Berger Paints Bangladesh Ltd	10	100
ResMed Inc	2	50
Ono Pharmaceutical Co Ltd	11	100
Shin Nippon Air Technologies Co Ltd	4	75
PolyNovo Ltd	2	50
Syneos Health Inc	3	50
Sanyo Electric Railway Co Ltd	0	0
Maruwa Unyu Kikan Co Ltd	0	0
Forest Water Environment Engineering Co Ltd	1	50
Replimune Group Inc	3	50
Iluka Resources Ltd	3	50
Polenergia SA	2	50
Enel Americas SA	4	75
Vinci SA	11	100
Naturgy Energy Group SA	6	75
Ryvu Therapeutics SA	1	50
Genfit	2	50
Recordati SpA	3	50
Ipsen SA	4	75
Iren SpA	0	0
Netia SA	4	75
Cosco Capital Inc	1	50
GTPL Hathway Ltd	2	50
Bestsun Energy Co Ltd	7	100
Qatar Electricity & Water Co QSC	8	100
Telefonica Brasil SA	5	75
Huadong Medicine Co Ltd	8	100
Omega Geracao SA	1	50
AngloGold Ashanti Ltd	6	75
Thai Airways International PCL	11	100
Elnusa Tbk PT	5	75
Vietnam National Petroleum Group	5	75
Petrovietnam Transportation Corp	6	75
Beximco Pharmaceuticals Ltd	7	100
Hoa Phat Group JSC	5	75
Orascom Construction PLC	1	50
Summit Power Ltd	7	100
MTN Nigeria Communications PLC	3	50
Minapharm Pharmaceuticals	0	0
Integrated Diagnostics Holdings PLC	3	50
Telecom Egypt Co	3	50

Appendix J: Considered Previous Allegation Cases

Company Name	Year	Case Description	Source
ResMed Inc	2020	Kickbacks in form of free call centre services, free loans and access to sleep tests for clients to incentivize purchases of equipment for Sleep Apne	https://www.justice.gov/opa/pr/resmed-corp-pay-united-states-375-million-allegedly-causing-false-claims-related-sale
Ono Pharmaceutical Co Ltd	2021	Two employees were arrested and prosecuted for bribery allegation by the Tsu District Public Prosecutors Office, Japan.	https://pj.jiho.jp/article/243717
Iluka Resources Ltd	2017	Sierra Rutile Ltd., acquired in December 2016 by Iluka Resources is alleged to bribe Sierra Leone cabinet minister Diana Konomanyi to obtain mining licenses in Sierra Leone.	https://www.traceinternational.org/TraceCompendium/Detail/840?type=1
Telefonica Brasil SA	2019	Tickets and benefits worth more than four million dollar were provided to politicians and officials with strategic influence in Brazil, that might support the business of Telefonica Brasil.	https://www.sec.gov/enforce/34-85819-s
AngloGold Ashanti Ltd	2015-2016	Official authorities in different countries prosecuted several employees of AngloGolg Ashanti for involvement in corruption affairs.	https://globalinvestigationsreview.com/just-anti-corruption/fcpa-docket-mining-company-fires-employees-part-of-corruption-probe
Thai Airways International PCL	2020	In 2020, the Thai National Anti-Corruption Commission (NACC) started investigations into corruption affairs with 20 suspects within Thai Airways.	https://thethaiger.com/hot-news/crime/thai-airways-procurement-probe-points-to-corruption
Petrovietnam Transportation Corp	2017	A top Vietnamese official has been sacked for corruption allegations while running national oil and gas firm PetroVietnam, in a rare public censure by the ruling Communist Party.	https://www.bbc.com/news/world-asia-39840943
MTN Nigeria Communications PLC	2019	Yusuf Saloojee, a South African diplomat, was arrested for facilitating bribes on behalf of MTN Group Ltd to both Iranian and South African officials.	https://www.diligenciagroup.com/insights-resources/mtn-more-than-a-corruption-and-bribery-accusation
Telecom Egypt Co	2019	Egypt's Administrative Control Authority announced they arrested several high-rank officials for bribery in the public procurement and contracting process.	https://english.ahram.org.eg/NewsContent/1/64/321892/-.aspx

Appendix K: Bribery prevention scores

Company name	Item 1	Item 2	Item 3	Item 4	Item 5	Item 6	Total score	FINAL SCORE
Rapid7 Inc	1	0	0	0	3	1	5	50
Ateam Inc	1	1	0	0	0	1	3	70
Kellogg Co	1	1	1	1	2	1	7	30
Tingyi Cayman Islands Holding Corp	1	1	1	1	2	3	9	10
Leoni AG	1	1	1	1	3	2	9	10
Sonoco Products Co	1	1	1	1	3	3	10	0
Jamco Corp	1	0	0	0	2	2	5	50
Gildan Activewear Inc	1	1	1	1	3	3	10	0
GCA Corp	1	0	0	0	0	3	4	60
East West Bancorp Inc	1	1	0	1	3	2	8	20
Embotelladora Andina SA	1	1	1	1	3	3	10	0
COIMA RES SpA	1	0	0	1	2	3	7	30
Banco BPM SpA	1	1	1	1	3	1	8	20
LVMH Moet Hennessy Louis Vuitton SE	1	1	1	1	3	2	9	10
Wallix Group	1	1	0	0	0	3	5	50
Exel Industries	1	1	0	1	2	3	8	20
Ram-On Investments & Holdings 1999 Ltd	0	0	0	0	0	2	2	80
OVS SpA	1	1	1	1	2	3	9	10
Antares Vision SpA	1	0	0	0	2	2	5	50
Alior Bank SA	1	0	0	1	2	2	6	40
Bajaj Holdings & Investment Ltd	1	0	0	0	3	2	6	40
Azul SA	1	0	0	1	2	2	6	40
Kajaria Ceramics Ltd	1	1	0	1	2	3	8	20
Fu Shou Yuan International Group Ltd	0	0	0	0	0	3	3	70
Shoucheng Holdings Ltd	1	1	1	1	3	3	10	0
AVI Ltd	1	1	1	1	3	2	9	10
Borosil Glass Works Ltd	1	0	0	1	2	3	7	30
Sunac China Holdings Ltd	1	1	1	1	1	1	6	40
Suning Universal Co Ltd	0	0	0	0	0	3	3	70
Via Varejo SA	1	1	0	1	3	1	7	30
Access Bank PLC	1	1	0	1	2	2	7	30
Oriental Weavers	0	0	0	0	0	2	2	80
Khang Dien House Trading and Investment JSC	0	0	0	0	0	1	1	90
Guinness Nigeria PLC	1	1	1	1	3	2	9	10
Stanbic IBTC Holdings PLC	1	0	0	0	2	3	6	40
Bank for Foreign Trade of Vietnam JSC	1	0	0	0	2	3	6	40
BBS Cables Ltd	0	0	0	0	0	3	3	70
Electro Cable Egypt	0	0	0	0	0	0	0	100
Egyptian Financial & Industrial Co	0	0	0	0	0	1	1	90
Berger Paints Bangladesh Ltd	0	0	0	1	0	3	4	60
ResMed Inc	1	1	0	1	0	1	4	60
Ono Pharmaceutical Co Ltd	1	1	1	1	3	2	9	10
Shin Nippon Air Technologies Co Ltd	1	0	0	1	1	2	5	50
PolyNovo Ltd	1	1	0	1	3	3	9	10
Syneos Health Inc	1	1	0	1	3	1	7	30
Sanyo Electric Railway Co Ltd	0	0	0	0	0	1	1	90
Maruwa Unyu Kikan Co Ltd	0	0	0	0	0	2	2	80
Forest Water Environment Engineering Co Ltd	0	0	0	0	0	2	2	80
Replimune Group Inc	1	1	0	1	0	3	6	40
Iluka Resources Ltd	1	1	1	1	3	3	10	0
Polenergia SA	1	0	1	0	1	1	4	60
Enel Americas SA	1	1	1	1	3	3	10	0
Vinci SA	1	1	1	1	3	3	10	0
Naturgy Energy Group SA	1	1	1	1	3	1	8	20
Ryvu Therapeutics SA	0	0	0	0	0	1	1	90
Genfit	1	1	1	1	2	0	6	40
Recordati SpA	1	1	1	1	3	3	10	0
Ipsen SA	1	1	1	1	2	1	7	30
Iren SpA	1	1	1	1	2	2	8	20
Netia SA	0	0	0	0	0	3	3	70
Cosco Capital Inc	1	1	0	1	1	1	5	50
GTPL Hathway Ltd	1	1	0	1	2	3	8	20
Bestsun Energy Co Ltd	0	0	0	0	0	1	1	90
Qatar Electricity & Water Co QSC	1	0	0	0	0	3	4	60
Telefonica Brasil SA	1	1	1	1	2	3	9	10
Huadong Medicine Co Ltd	1	0	0	0	0	1	2	80
Omega Geracao SA	0	0	0	0	0	1	1	90
AngloGold Ashanti Ltd	1	1	1	1	3	2	9	10
Thai Airways International PCL	1	1	1	1	2	3	9	10
Elnusa Tbk PT	1	1	1	1	3	3	10	0
Vietnam National Petroleum Group	1	1	1	1	0	3	7	30
Petrovietnam Transportation Corp	1	0	0	0	1	3	5	50
Beximco Pharmaceuticals Ltd	0	0	0	1	0	3	4	60
Hoa Phat Group JSC	0	0	0	0	0	2	2	80
Orascom Construction PLC	1	1	0	1	3	1	7	30
Summit Power Ltd	1	1	1	1	3	3	10	0
MTN Nigeria Communications PLC	1	1	0	1	2	0	5	50
Minapharm Pharmaceuticals	0	0	0	0	0	1	1	90
Integrated Diagnostics Holdings PLC	0	0	0	0	1	3	4	60
Telecom Egypt Co	0	0	0	0	0	2	2	80

Appendix L: Total List of sample firms including variable scores and FBRI

Rank	Name	Country risk	Country	Listing Country risk score	Country risk score	Subsidiary risk score	Ownership Score	Previous allegations score	PEP score	Anti corruption effort score	FBRI
1	Bestsun Energy Co Ltd	Moderate	China	54	54.00	85.00	0	0	100	90	68.15
2	LVMH Moet Hennessy Louis Vuitt	Low	France	24	82.00	82.00	0	0	100	10	61.20
3	Hoa Phat Group JSC	High	Vietnam	58	58.00	67.00	0	0	75	80	60.55
4	ResMed Inc	Very low	United States	20	65.33	61.00	0	100	50	60	60.12
5	Orascom Construction PLC	High	Egypt	64	63.33	85.00	100	0	50	30	59.42
6	Vinci SA	Low	France	24	75.67	91.00	0	0	100	0	59.23
7	AngloGold Ashanti Ltd	Moderate	South Africa	41	65.00	73.00	50	100	75	10	58.00
8	Naturgy Energy Group SA	Low	Spain	24	71.00	85.00	0	0	75	20	57.60
9	Telecom Egypt Co	High	Egypt	64	59.00	23.00	100	100	50	80	57.40
10	Omega Geracao SA	Moderate	Brazil	47	47.00	70.00	0	0	50	90	56.95
11	Qatar Electricity & Water Co QSC	Moderate	Qatar	50	49.00	50.50	100	0	100	60	56.78
12	Petrovietnam Transportation Cor	High	Vietnam	58	40.00	61.00	100	100	75	50	56.75
13	Khang Dien House Trading and In	High	Vietnam	58	58.00	52.00	0	0	50	90	56.30
14	Vietnam National Petroleum Gro	High	Vietnam	58	49.33	82.00	100	0	75	30	56.27
15	Electro Cable Egypt	High	Egypt	64	48.50	46.00	0	0	50	100	53.48
16	Beximco Pharmaceuticals Ltd	High	Bangladesh	66	52.00	46.00	0	0	100	60	51.70
17	BBS Cables Ltd	High	Bangladesh	66	66.00	37.00	0	0	50	70	51.35
17	Huadong Medicine Co Ltd	Moderate	China	54	31.00	58.00	0	0	100	80	51.35
17	Summit Power Ltd	High	Bangladesh	66	66.00	73.00	0	0	100	0	51.35
20	Integrated Diagnostics Holdings F	High	Egypt	64	58.33	55.00	0	0	50	60	51.17
21	Leoni AG	Very low	Germany	14	57.33	76.00	0	0	100	10	51.07
22	MTN Nigeria Communications PL	High	Nigeria	58	61.00	37.00	0	100	50	50	50.60
23	Egyptian Financial & Industrial Co	High	Egypt	64	64.00	0.00	100	0	50	90	50.40
24	Iluka Resources Ltd	Very low	Australia	15	56.00	82.00	0	100	50	0	50.10
25	Bajaj Holdings & Investment Ltd	Moderate	India	45	44.50	46.00	100	0	100	40	50.08
26	JSC Bank For Foreign Trade Of Vie	High	Vietnam	58	50.33	37.00	100	0	100	40	49.87
27	GCA Corp	Very low	Japan	19	52.33	32.50	0	0	100	60	48.44
28	Ipsen SA	Low	France	24	70.67	40.00	0	0	75	30	48.23
29	Netia SA	Low	Poland	34	34.00	58.00	0	0	75	70	47.90
30	Stanbic IBTC Holdings PLC	High	Nigeria	61	61.00	37.00	50	0	50	40	46.10
31	Oriental Weavers	High	Egypt	64	46.00	15.67	50	0	75	80	46.02
32	Thai Airways International PCL	Moderate	Thailand	47	27.00	58.00	100	100	100	10	45.95
33	Suning Universal Co Ltd	Moderate	China	54	54.00	21.67	0	0	75	70	45.82
34	Shin Nippon Air Technologies Co	Very low	Japan	19	40.00	55.00	0	0	75	50	45.25
35	Berger Paints Bangladesh Ltd	High	Bangladesh	66	66.00	0.00	0	0	100	60	45.10
36	Ono Pharmaceutical Co Ltd	Very low	Japan	19	44.33	49.00	0	100	100	10	44.77
37	Enel Americas SA	Low	Chile	29	45.67	85.00	0	0	75	0	44.73
38	Sonoco Products Co	Very low	United States	20	63.33	70.00	0	0	50	0	44.67
39	Elnusa Tbk PT	Moderate	Indonesia	44	44.00	67.00	100	0	75	0	44.65
40	Fu Shou Yuan International Grou	Moderate	China	54	36.50	28.00	0	0	100	70	43.78
41	Cosco Capital Inc	Moderate	Philippines	51	51.00	43.00	0	0	50	50	43.60
42	Access Bank PLC	High	Nigeria	61	69.00	32.50	0	0	50	30	43.28
43	Sanyo Electric Railway Co Ltd	Very low	Japan	19	19.00	73.00	0	0	0	90	42.90
43	Polenergia SA	Low	Poland	34	34.00	46.00	50	0	50	60	42.90
45	Forest Water Environment Engine	Very low	Taiwan	19	29.33	46.00	0	0	50	80	42.77
46	OVS SpA	Low	Italy	31	49.67	73.00	0	0	50	10	42.63
47	Exel Industries	Low	France	24	40.67	76.00	0	0	50	20	42.23
48	Via Varejo SA	Moderate	Brazil	47	47.00	49.00	0	0	75	30	42.20
49	Banco BPM SpA	Low	Italy	31	19.67	82.00	0	0	100	20	41.38
50	AVI Ltd	Moderate	South Africa	41	53.67	52.00	50	0	50	10	41.28
51	Ateam Inc	Very low	Japan	19	38.50	21.67	0	0	75	70	40.39
52	Kellogg Co	Very low	United States	20	79.67	25.00	0	0	0	30	40.13
53	Iren SpA	Low	Italy	31	45.00	70.00	50	0	0	20	39.75
54	Minapharm Pharmaceuticals	High	Egypt	64	39.00	31.00	0	0	0	90	39.40
55	Sunac China Holdings Ltd	Moderate	China	54	36.50	32.50	0	0	100	40	38.90
56	Azul SA	Moderate	Brazil	47	31.33	49.00	0	0	75	40	38.72
57	Ryvu Therapeutics SA	Low	Poland	34	24.00	28.00	0	0	50	90	38.40
57	Telefonica Brasil SA	Moderate	Brazil	47	29.00	55.00	0	100	75	10	38.40
59	Jamco Corp	Very low	Japan	19	30.00	67.00	0	0	0	50	37.25
60	Antares Vision SpA	Low	Italy	31	48.67	39.67	0	0	0	50	36.95
61	Rapid7 Inc	Very low	United States	20	23.33	55.00	0	0	50	50	36.92
62	COIMA RES SpA	Low	Italy	31	25.00	68.50	100	0	0	30	36.88
63	Shoucheng Holdings Ltd	Moderate	China	54	41.00	49.00	50	0	75	0	36.60
64	Maruwa Unyu Kikan Co Ltd	Very low	Japan	19	19.00	49.00	0	0	0	80	34.90
65	Embotelladora Andina SA	Low	Chile	29	47.67	49.00	0	0	50	0	33.93
66	Ram-On Investments & Holdings	Low	Israel	31	35.00	12.67	50	0	0	80	33.92
67	Alior Bank SA	Low	Poland	34	34.00	25.00	0	0	75	40	33.65
68	Recordati SpA	Low	Italy	31	51.67	40.00	0	0	50	0	33.08
69	Syneos Health Inc	Very low	United States	20	34.33	40.00	0	0	50	30	33.02
70	Gildan Activewear Inc	Very low	Canada	15	38.67	21.67	50	0	100	0	31.45
71	East West Bancorp Inc	Very low	United States	20	37.00	37.00	0	0	50	20	31.20
72	Genfit	Low	France	24	22.00	41.50	0	0	50	40	31.08
73	GTPL Hathway Ltd	Moderate	India	45	45.00	24.67	0	0	50	20	30.92
74	Tingyi Cayman Islands Holding Co	Very low	Hong Kong	19	36.50	25.00	0	0	75	10	28.53
75	Guinness Nigeria PLC	High	Nigeria	61	61.00	0.00	0	0	50	10	28.35
76	Wallix Group	Low	France	24	22.67	14.00	0	0	50	50	26.43
77	Replimune Group Inc	Very low	United States	20	17.00	28.00	0	0	50	40	25.95
78	Borosil Glass Works Ltd	Moderate	India	45	39.00	5.00	0	0	50	30	25.90
79	Kajaria Ceramics Ltd	Moderate	India	45	37.33	14.00	0	0	50	20	25.57
80	PolyNovo Ltd	Very low	Australia	15	14.33	31.00	0	0	50	10	19.77

Appendix M: SIC code mapping

	Category Description	3-Digit SIC Code	Ind. Code	Industry
A	**Agriculture, Forestry, Fishing**			
	Cash Grains	011	J	Agriculture, Forestry, And Fishing
	Field Crops, Except Cash Grains	013	J	Agriculture, Forestry, And Fishing
	Vegetables & Melons	016	J	Agriculture, Forestry, And Fishing
	Fruits and Tree Nuts	017	J	Agriculture, Forestry, And Fishing
	Horticultural Specialties	018	J	Agriculture, Forestry, And Fishing
	General Farms, Primarily Crops	019	J	Agriculture, Forestry, And Fishing
	Livestock, Except Dairy And Poultry	021	J	Agriculture, Forestry, And Fishing
	Dairy Farms	024	J	Agriculture, Forestry, And Fishing
	Poultry And Eggs	025	J	Agriculture, Forestry, And Fishing
	Animal Specialties	027	J	Agriculture, Forestry, And Fishing
	General Farms, Primarily Livestock And Animal	029	J	Agriculture, Forestry, And Fishing
	Soil Preparation Services	071	J	Agriculture, Forestry, And Fishing
	Crop Services	072	J	Agriculture, Forestry, And Fishing
	Veterinary Services	074	J	Agriculture, Forestry, And Fishing
	Farm Labor And Management Services	076	J	Agriculture, Forestry, And Fishing
	Landscape And Horticultural Services	078	J	Agriculture, Forestry, And Fishing
	Timber Tracts	081	J	Agriculture, Forestry, And Fishing
	Forest Nurseries And Gathering Of Forest	083	J	Agriculture, Forestry, And Fishing
	Forestry Services	085	J	Agriculture, Forestry, And Fishing
	Commercial Fishing	091	J	Agriculture, Forestry, And Fishing
	Fish Hatcheries And Preserves	092	J	Agriculture, Forestry, And Fishing
	Hunting And Trapping, And Game Propagation	097	J	Agriculture, Forestry, And Fishing
B	**Mining**			
	Iron ores	101	A	Extraction
	Copper ores	102	A	Extraction
	Lead and zinc ores	103	A	Extraction
	Gold and silver ores	104	A	Extraction
	Metal mining services	108	A	Extraction
	Miscellaneous metal ores	109	A	Extraction
	Bituminous coal and lignite mining	122	A	Extraction
	Anthracite mining	123	A	Extraction
	Coal mining services	124	A	Extraction
	Crude petroleum and natural gas	131	A	Extraction
	Natural gas liquids	132	A	Extraction
	Oil and gas field services	138	A	Extraction
	Dimension stone	141	A	Extraction
	Crushed and broken stone, including riprap	142	A	Extraction
	Sand and gravel	144	A	Extraction
	Clay, ceramic, and refractory minerals	145	A	Extraction
	Chemical and fertilizer mineral mining	147	A	Extraction
	Nonmetallic minerals services, except fuels	148	A	Extraction
	Miscellaneous nonmetallic minerals, except fuels	149	A	Extraction
C	**Construction industries**			
	General contractors--residential buildings	152	C	Construction
	Operative builders	153	C	Construction
	General building contractors--nonresidential buildings	154	C	Construction
	Highway and street construction contractors, except elevated highways	161	C	Construction
	Heavy construction, except highway and street construction	162	C	Construction
	Plumbing, heating, and air-conditioning special trade contractors	171	C	Construction
	Painting and paper hanging special trade contractors	172	C	Construction
	Electrical work special trade contractors	173	C	Construction
	Masonry, stone work, tile setting, and plastering special trade contractors	174	C	Construction
	Carpentry and floor work special trade contractors	175	C	Construction
	Roofing, siding, and sheet metal work special trade contractors	176	C	Construction
	Concrete work special trade contractors	177	C	Construction
	Water well drilling special trade contractors	178	C	Construction
	Miscellaneous special trade contractors	179	C	Construction
D	**Manufacturing**			
	Meat products	201	F	Manufacturing
	Dairy products	202	F	Manufacturing
	Preserved fruits and vegetables	203	F	Manufacturing

	Grain mill products	204	F	Manufacturing
	Bakery products	205	F	Manufacturing
	Sugar and confectionery products	206	F	Manufacturing
	Fats and oils	207	F	Manufacturing
	Beverages	208	F	Manufacturing
	Miscellaneous food and kindred products	209	F	Manufacturing
	Cigarettes	211	F	Manufacturing
	Cigars	212	F	Manufacturing
	Chewing and smoking tobacco	213	F	Manufacturing
	Tobacco stemming and redrying	214	F	Manufacturing
	Broadwoven fabric mills, cotton	221	F	Manufacturing
	Broadwoven fabric mills, manmade fiber and silk	222	F	Manufacturing
	Broadwoven fabric mills, wool	223	F	Manufacturing
	Narrow fabric mills	224	F	Manufacturing
	Knitting mills	225	F	Manufacturing
	Textile finishing, except wool	226	F	Manufacturing
	Carpets and rugs	227	F	Manufacturing
	Yarn and thread mills	228	F	Manufacturing
	Miscellaneous textile goods	229	F	Manufacturing
	Men's and boys' suits and coats	231	F	Manufacturing
	Men's and boys' furnishings	232	F	Manufacturing
	Women's and children's outerwear	233	F	Manufacturing
	Women's and children's undergarments	234	F	Manufacturing
	Hats, caps, and millinery	235	F	Manufacturing
	Girls' and children's outerwear	236	F	Manufacturing
	Fur goods	237	F	Manufacturing
	Miscellaneous apparel and accessories	238	F	Manufacturing
	Miscellaneous fabricated textile products	239	F	Manufacturing
	Logging	241	J	Agriculture, Forestry, And Fishing
	Sawmills and planing mills	242	F	Manufacturing
	Millwork, plywood, and structural members	243	F	Manufacturing
	Wood containers	244	F	Manufacturing
	Wood buildings and mobile homes	245	F	Manufacturing
	Miscellaneous wood products	249	F	Manufacturing
	Household furniture	251	F	Manufacturing
	Office furniture	252	F	Manufacturing
	Public building and related furniture	253	F	Manufacturing
	Partitions and fixtures	254	F	Manufacturing
	Miscellaneous furniture and fixtures	259	F	Manufacturing
	Pulp mills	261	F	Manufacturing
	Paper mills	262	F	Manufacturing
	Paperboard mills	263	F	Manufacturing
	Paperboard containers and boxes	265	F	Manufacturing
	Miscellaneous converted paper products	267	F	Manufacturing
	Newspapers	271	F	Manufacturing
	Periodicals	272	F	Manufacturing
	Books	273	F	Manufacturing
	Miscellaneous publishing	274	F	Manufacturing
	Commercial printing	275	F	Manufacturing
	Manifold business forms	276	F	Manufacturing
	Greeting cards	277	F	Manufacturing
	Blankbooks and bookbinding	278	F	Manufacturing
	Printing trade services	279	F	Manufacturing
	Industrial inorganic chemicals	281	F	Manufacturing
	Plastics materials and synthetics	282	F	Manufacturing
	Drugs	283	B	Human health
	Soaps, cleaners, and toilet goods	284	F	Manufacturing
	Paints and allied products	285	F	Manufacturing
	Industrial organic chemicals	286	F	Manufacturing
	Agricultural chemicals	287	F	Manufacturing
	Miscellaneous chemical products	289	F	Manufacturing
	Petroleum refining	291	A	Extraction
	Asphalt paving and roofing materials	295	A	Extraction
	Miscellaneous petroleum and coal products	299	A	Extraction
	Tires and inner tubes	301	F	Manufacturing
	Rubber and plastics footwear	302	F	Manufacturing
	Hose and belting and gaskets and packing	305	F	Manufacturing
	Fabricated rubber products, n.e.c.	306	F	Manufacturing
	Miscellaneous plastics products, n.e.c.	308	F	Manufacturing
	Leather tanning and finishing	311	F	Manufacturing
	Footwear cut stock	313	F	Manufacturing

	Footwear, except rubber	314	F	Manufacturing
	Leather gloves and mittens	315	F	Manufacturing
	Luggage	316	F	Manufacturing
	Handbags and personal leather goods	317	F	Manufacturing
	Leather goods, n.e.c.	319	F	Manufacturing
	Flat glass	321	F	Manufacturing
	Glass and glassware, pressed or blown	322	F	Manufacturing
	Products of purchased glass	323	F	Manufacturing
	Cement, hydraulic	324	F	Manufacturing
	Structural clay products	325	F	Manufacturing
	Pottery and related products	326	F	Manufacturing
	Concrete, gypsum, and plaster products	327	F	Manufacturing
	Cut stone and stone products	328	F	Manufacturing
	Miscellaneous nonmetallic mineral products	329	F	Manufacturing
	Blast furnace and basic steel products	331	F	Manufacturing
	Iron and steel foundries	332	F	Manufacturing
	Primary nonferrous metals	333	F	Manufacturing
	Secondary nonferrous metals	334	F	Manufacturing
	Nonferrous rolling and drawing	335	F	Manufacturing
	Nonferrous foundries (castings)	336	F	Manufacturing
	Miscellaneous primary metal products	339	F	Manufacturing
	Metal cans and shipping containers	341	F	Manufacturing
	Cutlery, handtools, and hardware	342	F	Manufacturing
	Plumbing and heating, except electric	343	F	Manufacturing
	Fabricated structural metal products	344	F	Manufacturing
	Screw machine products, bolts, etc.	345	F	Manufacturing
	Metal forgings and stampings	346	F	Manufacturing
	Metal services, n.e.c.	347	F	Manufacturing
	Ordnance and accessories	348	D	Defense
	Miscellaneous fabricated metal products	349	F	Manufacturing
	Engines and turbines	351	F	Manufacturing
	Farm and garden machinery	352	F	Manufacturing
	Construction and related machinery	353	C	Construction
	Metalworking machinery	354	F	Manufacturing
	Special industry machinery	355	F	Manufacturing
	General industrial machinery, including military machinery	356	D	Defense
	Computer and office equipment	357	F	Manufacturing
	Refrigeration and service machinery	358	F	Manufacturing
	Industrial machinery, n.e.c.	359	F	Manufacturing
	Electric distribution equipment	361	F	Manufacturing
	Electrical industrial apparatus, including Electrical defense components	362	D	Defense
	Household appliances	363	F	Manufacturing
	Electric lighting and wiring equipment	364	F	Manufacturing
	Household audio and video equipment	365	F	Manufacturing
	Communications equipment	366	F	Manufacturing
	Electronic components and accessories	367	F	Manufacturing
	Miscellaneous electrical equipment and supplies	369	F	Manufacturing
	Motor vehicles and equipment	371	F	Manufacturing
	Aircraft and parts	372	F	Manufacturing
	Ship and boat building and repairing	373	F	Manufacturing
	Railroad equipment	374	F	Manufacturing
	Motorcycles, bicycles, and parts	375	F	Manufacturing
	Guided missiles, space vehicles, parts	376	D	Defense
	Miscellaneous transportation equipment	379	F	Manufacturing
	Search and navigation equipment	381	F	Manufacturing
	Measuring and controlling devices	382	F	Manufacturing
	Medical instruments and supplies	384	B	Human health
	Ophthalmic goods	385	B	Human health
	Photographic equipment and supplies	386	F	Manufacturing
	Watches, clocks, watchcases, and parts	387	F	Manufacturing
	Jewelry, silverware, and plated ware	391	F	Manufacturing
	Musical instruments	393	F	Manufacturing
	Toys and sporting goods	394	F	Manufacturing
	Pens, pencils, office, and art supplies	395	F	Manufacturing
	Costume jewelry and notions	396	F	Manufacturing
	Miscellaneous manufactures	399	F	Manufacturing
E	**Transportation, communications, and utilities**			
	Railroad Transportation	401	G	Transportation
	Local and suburban passenger transportation	411	L	Service Industries

	Taxi service	412	L	Service Industries
	Interurban and rural bus transportation	413	L	Service Industries
	Charter bus service	414	L	Service Industries
	School bus service	415	L	Service Industries
	Bus terminal and service facilities	417	L	Service Industries
	Trucking and courier services, except air	421	G	Transportation
	Public warehousing and storage	422	G	Transportation
	Trucking terminal facilities	423	G	Transportation
	Deep sea freight transportation	441	G	Transportation
	Coastal and intercoastal freight transportation	442	G	Transportation
	Great Lakes - St. Lawrence Seaway freight transportation	443	G	Transportation
	Inland waterways freight transportation	444	G	Transportation
	Water transportation of passengers	448	G	Transportation
	Services incidental to water transportation	449	G	Transportation
	Scheduled air transportation and air courier services	451	G	Transportation
	Nonscheduled air transportation	452	G	Transportation
	Airport terminal services	458	G	Transportation
	Pipelines, except natural gas	461	G	Transportation
	Arrangement of passenger transportation	472	G	Transportation
	Freight shipping services	473	G	Transportation
	Railroad car rental	474	G	Transportation
	Miscellaneous services incidental to transportation	478	G	Transportation
	Telephone	481	E	Telecommunication
	Telegraph communications	482	E	Telecommunication
	Radio and television broadcasting	483	E	Telecommunication
	Cable and other pay television broadcasting	484	E	Telecommunication
	Communication services, not elsewhere classified	489	E	Telecommunication
	Electric services	491	H	Utilities
	Gas production and distribution	492	H	Utilities
	Combination utility services	493	H	Utilities
	Water supply	494	H	Utilities
	Sanitary services	495	H	Utilities
	Steam and air-conditioning supply	496	H	Utilities
	Irrigation systems	497	H	Utilities
F	**Wholesale trade**			
	Motor vehicles and motor vehicle parts and supplies	501	K	Wholesale and retail
	Furniture and home furnishings	502	K	Wholesale and retail
	Lumber and other construction materials	503	K	Wholesale and retail
	Professional and commercial equipment and supplies	504	K	Wholesale and retail
	Metals and minerals, except petroleum	505	K	Wholesale and retail
	Electrical goods	506	K	Wholesale and retail
	Hardware and plumbing and heating equipment and supplies	507	K	Wholesale and retail
	Machinery, equipment, and supplies	508	K	Wholesale and retail
	Miscellaneous durable goods	509	K	Wholesale and retail
	Paper and paper products	511	K	Wholesale and retail
	Drugs, drug proprietaries, and druggists' sundries	512	K	Wholesale and retail
	Apparel, piece goods, and notions	513	K	Wholesale and retail
	Groceries and related products	514	K	Wholesale and retail
	Farm-product raw materials	515	K	Wholesale and retail
	Chemicals and allied products	516	K	Wholesale and retail
	Petroleum and petroleum products	517	A	Extraction
	Beer, wine, and distilled alcoholic beverages	518	K	Wholesale and retail
	Miscellaneous nondurable goods	519	K	Wholesale and retail
G	**Retail trade**			
	Lumber and other building materials dealers	521	K	Wholesale and retail
	Paint, glass, and wallpaper stores	523	K	Wholesale and retail
	Hardware stores	525	K	Wholesale and retail
	Retail nurseries, lawn and garden supply stores	526	K	Wholesale and retail
	Mobile home dealers	527	K	Wholesale and retail
	Department stores (excluding leased departments)	531	K	Wholesale and retail
	Variety stores	533	K	Wholesale and retail
	Miscellaneous general merchandise stores	539	K	Wholesale and retail
	Grocery stores	541	K	Wholesale and retail
	Meat and fish (seafood) markets, including freezer provisioners	542	K	Wholesale and retail
	Fruit and vegetable markets	543	K	Wholesale and retail
	Candy, nut, and confectionery stores	544	K	Wholesale and retail
	Dairy products stores	545	K	Wholesale and retail
	Retail bakeries	546	K	Wholesale and retail

	Miscellaneous food stores	549	K	Wholesale and retail
	Motor vehicle dealers (new and used)	551	K	Wholesale and retail
	Motor vehicle dealers (used only)	552	K	Wholesale and retail
	Auto and home supply stores	553	K	Wholesale and retail
	Gasoline service stations	554	K	Wholesale and retail
	Boat dealers	555	K	Wholesale and retail
	Recreational vehicle dealers	556	K	Wholesale and retail
	Motorcycle dealers	557	K	Wholesale and retail
	Automotive dealers, not elsewhere classified	559	K	Wholesale and retail
	Men's and boys' clothing and accessory stores	561	K	Wholesale and retail
	Women's clothing stores	562	K	Wholesale and retail
	Women's accessory and specialty stores	563	K	Wholesale and retail
	Children's and infants' wear stores	564	K	Wholesale and retail
	Family clothing stores	565	K	Wholesale and retail
	Shoe stores	566	K	Wholesale and retail
	Miscellaneous apparel and accessory stores	569	K	Wholesale and retail
	Home furniture and furnishings stores	571	K	Wholesale and retail
	Household appliance stores	572	K	Wholesale and retail
	Radio, television, consumer electronics, and music stores	573	K	Wholesale and retail
	Eating and drinking places	581	K	Wholesale and retail
	Drug stores and proprietary stores	591	K	Wholesale and retail
	Liquor stores	592	K	Wholesale and retail
	Used merchandise stores	593	K	Wholesale and retail
	Miscellaneous shopping goods stores	594	K	Wholesale and retail
	Nonstore retailers	596	K	Wholesale and retail
	Fuel dealers	598	A	Extraction
	Retail stores, not elsewhere classified	599	K	Wholesale and retail
H	**Financial, insurance, and real estate industries**			
	Central reserve depository institutions	601	I	Financial services
	Commercial banks	602	I	Financial services
	Savings institutions	603	I	Financial services
	Credit unions	606	I	Financial services
	Foreign banking and branches and agencies of foreign banks	608	I	Financial services
	Functions related to depository banking	609	I	Financial services
	Federal & federally-sponsored credit agencies	611	I	Financial services
	Personal credit institutions	614	I	Financial services
	Business credit institutions	615	I	Financial services
	Mortgage bankers and brokers	616	I	Financial services
	Security brokers, dealers, and flotation companies	621	I	Financial services
	Commodity contracts brokers and dealers	622	I	Financial services
	Security and commodity exchanges	623	I	Financial services
	Services allied with the exchange of securities or commodities	628	I	Financial services
	Life insurance	631	I	Financial services
	Accident and health insurance and medical service plans	632	I	Financial services
	Fire, marine, and casualty insurance	633	I	Financial services
	Surety insurance	635	I	Financial services
	Title insurance	636	I	Financial services
	Pension, health, and welfare funds	637	I	Financial services
	Insurance carriers, n.e.c.	639	I	Financial services
	Insurance agents, brokers, and services	641	I	Financial services
	Real estate operators (except developers) and lessors	651	I	Financial services
	Real estate agents and managers	653	I	Financial services
	Title abstract offices	654	I	Financial services
	Land subdividers and developers	655	I	Financial services
	Holding offices	671	I	Financial services
	Investment offices	672	I	Financial services
	Trusts	673	I	Financial services
	Miscellaneous investing	679	I	Financial services
I	**Service industries**			
	Hotels & motels	701	L	Service Industries
	Rooming & boarding houses	702	L	Service Industries
	Camps and recreational vehicle parks	703	L	Service Industries
	Power laundries, family & commercial	721	L	Service Industries
	Photographic studios, portrait	722	L	Service Industries
	Beauty shops	723	L	Service Industries
	Barber shops	724	L	Service Industries
	Shoe repair shops & shoeshine parlors	725	L	Service Industries
	Funeral service & crematories	726	L	Service Industries

	Miscellaneous personal services	729	L	Service Industries
	Advertising Services	731	L	Service Industries
	Consumer Credit Reporting / Mercantile Services	732	L	Service Industries
	Mailing, Reproduction & Commerical Art Services	733	L	Service Industries
	Services to Dwellings & Other Buildings	734	L	Service Industries
	Miscellaneous Equipment Rental & Leasing, incl. Oilfield & well drilling equipment rental & leasing	735	A	Extraction
	Personnel Supply Services	736	L	Service Industries
	Computer Programming and Data Processing	737	L	Service Industries
	Miscellaneous Business Services	738	L	Service Industries
	Automotive Rental And Leasing, Without Drivers	751	L	Service Industries
	Automobile parking	752	L	Service Industries
	Automotive repair shops	753	L	Service Industries
	Automotive Services, Except Repair	754	L	Service Industries
	Repair Services	762	L	Service Industries
	Electrical Repair Shops	762	L	Service Industries
	Watch, clock, & jewelry repair	763	L	Service Industries
	Reupholstery & furniture repair	764	L	Service Industries
	Miscellaneous Repair Shops And Related Services	769	L	Service Industries
	Motion Picture Services	762	L	Service Industries
	Motion Picture Production And Allied Services	781	L	Service Industries
	Motion Picture Distribution And Allied Services	782	L	Service Industries
	Motion picture theaters	783	L	Service Industries
	Video tape rental	784	L	Service Industries
	Dance studios, schools, and halls	791	L	Service Industries
	Theatrical producers (except motion picture) bands, orchestras, and entertainers	792	L	Service Industries
	Bowling centers	793	L	Service Industries
	Commercial sports	794	L	Service Industries
	Miscellaneous amusement and recreation services	799	L	Service Industries
	Offices and clinics of doctors of medicine	801	B	Human health
	Offices and clinics of dentists	802	B	Human health
	Offices & clinics of doctors of osteopathy	803	B	Human health
	Offices And Clinics Of Other Health Practitioners	804	B	Human health
	Nursing and personal care facilities	805	B	Human health
	Hospitals	806	B	Human health
	Medical & Dental laboratories	807	B	Human health
	Home health care services	808	B	Human health
	Miscellaneous health and allied services, not elsewhere classified	809	B	Human health
	Legal services	811	L	Service Industries
	Elementary & Secondary Schools	821	L	Service Industries
	Colleges, Universities, Professional Schools	822	L	Service Industries
	Libraries	823	L	Service Industries
	Vocational schools	824	L	Service Industries
	Schools and educational services, not elsewhere classified	829	L	Service Industries
	Individual and family social services	832	L	Service Industries
	Job training and vocational rehabilitation services	833	L	Service Industries
	Child daycare services	835	L	Service Industries
	Residential care	836	L	Service Industries
	Social services, not elsewhere classified	839	L	Service Industries
	Museums and art galleries	841	L	Service Industries
	Arboreta and botanical or zoological gardens	842	L	Service Industries
	Business Associations	861	L	Service Industries
	Professional Membership Organizations	862	L	Service Industries
	Labor Unions And Similar Labor Organizations	863	L	Service Industries
	Civic, Social, And Fraternal Associations	864	L	Service Industries
	Political Organizations	865	L	Service Industries
	Religious Organizations	866	L	Service Industries
	Membership organizations, not elsewhere classified	869	L	Service Industries
	Engineering, Architectural, Surveying Service	871	L	Service Industries
	Accounting, auditing, & bookkeeping services	872	L	Service Industries
	Research, development, and testing services (except noncommercial research organizations)	873	L	Service Industries
	Management and public relations services	874	L	Service Industries
	Private Households	881	L	Service Industries
	Miscellaneous Services, Not Classified Elsewhere	899	L	Service Industries

Appendix N: R script and data sets

The complete R script, as well as the underlying datasets used for the analyses can be accessed at: https://github.com/gsterbinszky/TRACE. The script contains the data preparation, random sampling, analysis, and visualization step taken to conduct our analysis.