THE RISK AWARENESS OF SOVEREIGN WEALTH FUNDS IN RELATION TO ESG ASSETS: DO BIGGEST WORLD INSTITUTIONAL INVESTORS ACT SUSTAINABLY?

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ABSTRACT

This paper investigates the dependence of the investment behavior of Sovereign Wealth Funds (SWFs) on the Environmental, Social, and Governance (ESG) performance of their underlying investments in public equity holdings during the period of 2007 to 2022 collectively overseeing a substantial 71% of total public equity holding investments by SWFs globally. The unique data set with ESG control variables consist of mainly self-reported Corporate Social Responsibility (CSR) ESG information (ESG rating from Refinitiv/LSEG) and dynamic risk assessed ESG information purely based on external evaluation of the firms (Reputational Risk Indicator from RepRisk). The control variable which monitors the Corporate Social Irresponsibility (CSI) of target companies is novel to previous studies. Our findings suggest that SWFs still consider self-reported CSR information more than public CSI data in their investment decisions. Furthermore, a change in past ESG data of underlying public equity holdings – both CSR and CSI – does not seem to have a significant effect on the investment into underlying public equity holdings. Our conclusions could help to encourage greater ESG integration into SWF investment strategies and promote sustainable investing practices more broadly not limited to liquid assets.

KEY WORDS

Sovereign Wealth Funds, ESG, reputation risk, Corporate Social Responsibility, Corporate Social Irresponsibility

JEL CODES

D81, F64, G11, G32, M14, Q01

1 INTRODUCTION

Sovereign Wealth Funds (SWFs), alongside pension funds and insurance companies, rank as formidable global institutional investors, commanding considerable influence and sizeable financial power (Rozanov, 2005; Aggarwal and Goodell, 2018). What makes them a common

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community is the fact that they are state-owned with governance bodies influencing their aims and taking responsibility for their outcomes (Aizenman and Glick, 2009; Grasso, 2017). Many are financed by the sale of commodities, e.g., oil and gas, like those SWFs from Norway, Kuwait, and Abu Dhabi (Bassan, 2015). SWFs have immense impacts on the sustainability of economies (Sharma, 2017; Stulz, 2005). Over the last decade, there has been an increased emphasis on the three pillars of social, economic, and environmental sustainability by both theorists and practitioners alike. As highlighted in studies by Bautista-Puig et al. (2021), Chmelíková and Redlichová (2020), and Kölbel et al. (2020), social sustainability refers to the well-being and quality of life of individuals and communities. Economic sustainability refers to the creation of economic systems that promote long-term growth and stability, while environmental sustainability focuses on preserving natural resources and reducing the negative impacts of human activities on the environment.

The influence of SWFs on the resilience of the world economy is significant. As per the studies conducted by Adonu (2020) and Chmelíková and Redlichová (2013), SWFs are instrumental in promoting sustainable economic growth by investing in innovative technologies and sustainable business practices. SWFs allocate their investments across diverse sectors, encompassing renewable energy, clean technology, sustainable agriculture, and other areas, showcasing their typically broad investment portfolios. By doing so, they can contribute to the development of a sustainable economy and help to reduce carbon emissions. Even though their investment behavior has been analyzed in prior research (Liang and Renneboog, 2020; Dai et al., 2022), their focused investment decision-making regarding several asset classes remains largely opaque (Aggarwal and Goodell, 2018). Little is known about the transmission channels that allow for unsustainable development factors to impact SWFs' investment decisions (Avendano, 2010). The objectives or purposes of SWFs can play a significant role in their disclosure behavior on Environment, Social, and Governance- (ESG-) and Sustainable Development Goals- (SDG-) related topics. It is important that SWFs are transparent in their disclosure behavior, regardless of their objectives, to ensure that their investments are aligned with broader sustainable development objectives (Chmelíková and Somerlíková, 2018; Klein, 2021).

With global assets under management of USD 10.2 trillion (SWF Institute, 2023a) it is important to understand whether there is a common denominator which drives the investment decisions of SWFs. During the global financial crisis in 2008, it was this opaqueness which got the attention of global policy makers. On the one hand, SWFs were invited to stabilize financial markets through their investments in listed equity. On the other hand, SWFs thereby gained significantly more influence in listed companies (Wagner, 2013). SWFs have answered with the establishment of the International Forum of SWFs (IFSWF), and many signed the Santiago Principles in 2009 to demonstrate their willingness to collaborate and adopt greater transparency in their operations (IWG, 2008). The desire to improve transparency is also reflected in the creation of the Linaburg-Maduell Transparency Index (LMTI) introduced in 2008 (SWF Institute, 2023a). However, do SWFs care about the sustainability of their investments, and what are the drivers of their responsible behavior?

There is growing body of literature (Liang and Renneboog, 2020; Farag et al., 2022) dealing with the ability of SWFs to incorporate ESG considerations into their investment decisions. The studies are based on the evaluation of the relationship between ownership stakes in underlying companies and their ESG scores. They reveal that SWFs consider both historical ESG performance and recent improvements in ESG scores when acquiring ownership stakes in publicly traded companies, as highlighted by Liang and Renneboog (2020). However, ESG scores suffer from several shortcomings. First, they are to a large extend based on company self-reported CSR information which makes their content opaque (Bautista-Puig et al., 2021; Jory et al., 2010). In other cases, ESG ratings calculated by different providers disagree

substantially (Berg et al., 2022). The divergence in ESG measurements occurs due to the varying scope, measurement, and weight of ESG parameters. Most have already developed special, at least yearly, reports and use their homepage for publication (Klein, 2021). This holds also true for publications regarding sustainability (Maslova, 2020), e.g., the One Planet Sovereign Wealth Funds initiative (One Planet SWFs, 2023) as well as ESG and SDG reporting (Klein, 2021). To overcome the obstacles presented by self-disclosed information gleaned from firms' annual reports, reputation measures revealed by the media can be used (Kölbel et al., 2017). The root of this idea is that many studies (Chava, 2014; Oikonomou et al., 2014) differentiate between Corporate Social Responsibility (CSR) that is self-disclosed in a firm's annual report and its negative counterpart Corporate Social Irresponsibility (CSI) which is usually revealed by media and social networks.

We follow the same logic and suggest that while traditional ESG scores informing on the CSR performance are to a large extend based on company self-reported CSR information, the ESG indicator derived from reputation risk reflects real behavior of firms related to CSI. Inspired by the preceding body of work, our study empirically delves into the research question of the extent to which SWFs respond to fluctuations in the ESG ratings of their underlying assets, seeking to elucidate the dynamics and implications of ESG considerations in the investment decision-making process of SWFs. The research question to be analyzed is:

Are SWF sensitive to ESG CSI data when considering an investment in public equity holdings?

Our research contributes to the literature on the impact of CSI factors on the investment decision-making process of SWFs, particularly in relation to their investments in publicly traded equity holdings. This analysis endeavors to bridge the existing research gap by examining the relationship between SWF ownership and the ESG reputation risk of target firms. To measure the CSI associated with individual firms, we utilized an objective indicator based on external evaluations of the target companies. Specifically, we employed the RepRisk dataset, which monitors media coverage of incidents affecting the ESG performance of firms based on a dynamic risk assessment methodology.

The remainder of our paper proceeds as follows: part two reviews previous empirical studies focusing on the relationship between the ESG performance of target firms and SWF ownership stake. Based on this overview, we develop our hypotheses. Part three describes the methods, the data used to answer our research questions, and the model limitations. The analysis presented in the fourth part applies an econometric approach to identify the extent to which changing the ESG performance of target firms influences the ownership stake held by SWFs. Results are shown and discussed. The final part five contains a conclusion and outlook discussion of our main results and conclusions, the particular limitations of our study, and including possible further research.

2 THEORETICAL BACKGROUND AND HYPOTHESES

There are several types of incentives for SWFs to care about their portfolio companies' ESG- and SDG-related practices. First, SWFs operate on behalf of whole generations and should act in their interests. Furthermore, responsible investing has emerged as an integral aspect of societal preferences, reflecting an increasing awareness and consideration of ESG factors in investment decision-making. Recent empirical research has unveiled a positive association between a firm's CSR profile and its financial performance, as evidenced by studies conducted by Malik et al. (2023) and Dyck et al. (2018). Additionally, Ding et al. (2019) observe a positive relation between a firm's CSR profile and socio-economic conditions of the geographic location of their headquarters. These facts constitute important reasons for responsible be-

havior by the governments which direct SWFs. However, the responses by SWFs to changes in the ESG activities of underlying companies differ broadly. An expanding corpus of scholarly literature has been dedicated to examining the extent and way SWFs integrate ESG considerations into their investment decision-making processes, highlighting the increasing scrutiny directed towards this topic. There are also several empirical studies focusing on the inverse relationship – meaning the influence of SWF ownership on firm ESG score. (Farag et al., 2022).

The first direction of research taken on the mutual relationship between SWFs and the ESG performance of their underlying publicly listed corporations is more comprehensive than the opposite direction taken by other researchers (Bernstein et al., 2013). Liang and Renneboog (2020) showed in a sample of 24 SWFs – representing 83.75% of total SWF public equity holding assets under management (AuM) from 2009 to 2018 – that SFWs consider both the historical and recent ESG performance of publicly listed companies when making decisions regarding ownership stakes, showcasing the significance of ESG factors in their investment strategies. They identified the major drivers of this relationship, which are the explicit or implicit ESG policy of the SWF and its level of transparency. The origin of SWFs emerged as a crucial factor influencing the investment decision-making process, with SWFs from developed countries and countries with civil law origins demonstrating higher sensitivity to ESG considerations in comparison to their counterparts from developing regions, as elucidated by Megginson and Fotak (2015). According to Liang and Renneboog (2020), firms with higher ESG ratings are more frequently targeted for ownership by SWFs, who also tend to acquire larger ownership stakes in such companies. Many SWFs with ESG policies hold the belief that proficient management of ESG risks and opportunities contributes to maximizing returns on investments, underlining the growing recognition of the link between ESG factors and financial performance. Their main control variable – the ESG score of the underlying companies – was for the purposes of their study collected from Thomson Reuters' Asset4 ESG ratings.

Use of ESG ratings from one source decreases the reliability of the results, while Berg et al. (2022) claim that ESG ratings from different providers disagree substantially. The authors detected several sources of these divergences. Measurement methodology contributes 56% of the divergence, scope of ratios 38%, and their weight 6%. To overcome this shortcoming, the authors suggested that the control variable of the firm's ESG engagement should be based on several sources. Dai et al. (2022) conducted a study investigating the significance of a firm's ESG engagement for the investment decision-making process of SWFs, shedding light on the evolving considerations and dynamics surrounding ESG factors affecting SWF investments. Their sample covered all SWF investments in publicly traded US firms over the period 2003–2018. Their findings confirmed that ESG is an important factor for SWFs when making investment decisions and showed that SWF ownership in the target firm increased the probability that higher ESG engagement would attract more SWFs to invest. The authors used a control variable of ESG engagement more comprehensive than that of Liang and Renneboog (2020). The information on ESG performance came from the Kinder Lydenburg and Domini database, which is a standard source for CSR measurement. This database deploys information from financial statements, annual reports, media, governmental reports, and employee surveys.

In contrast to previous studies on this relationship, we use the ESG indicator based on the irresponsible behavior of target firms instead of traditional ESG rating as the main control variable. The point is that ESG indicators informing about irresponsible behavior is a third-party evaluation, which according to Kölbel et al. (2017) results in fundamental contrast to CSR regarding the way the information is created and distributed. Typically, traditional ESG ratings are based on CSR information which is self-disclosed by firms and distributed in CSR reports (Amran et al., 2021; Bischoff and Wood, 2019). ESG reputation risk information,

in contrast, is created by external evaluators and typically distributed in the media and social networks. To verify this conjecture, we deploy in our model two measures on ESG performance controlling for both Corporate Social Responsibility (ESGR) and its negative counterpart Corporate Social Irresponsibility (ESGI). The latter one becomes our main control variable as this constitutes the central contribution of our article – to examine the investment decision – making process of SWFs regarding public equity holdings and their ESGI behavior. Based on this we hypothesize a negative effect of irresponsible behavior of underlying public equity holdings on the SWFs investment behavior.

This leads us to the following two hypotheses that are based on underlying rationales from existing literature which are consequently to be tested and either accepted or rejected:

Hypothesis 1: Influence of public equity holding CSI data on the investment decision of SWFs.

H_1: *Public equity holding Corporate Social Irresponsibility data has a pronounced influence on the investment decision of SWFs.*

To test and then possibly find support for the hypothesis, the following alternative null hypothesis has been formulated:

H_1 null: *There is no influence of public equity holding Corporate Social Irresponsibility data on the investment decision of SWFs regarding public equity holdings.*

Hypothesis 2: Influence of public equity holding CSI data compared to company self-reported CSR information on the investment decision of SWFs.

H_2: *The influence of public equity holding Corporate Social Irresponsibility data on the investment decision of SWFs is not higher than the influence of company self-reported CSR information.*

To test and then possibly find support for the hypothesis, the following alternative null hypothesis has been formulated:

H_2 null: *The influence of public equity holding Corporate Social Irresponsibility data on the investment decision of SWFs is higher than the influence of company self-reported CSR information.*

3 METHODS, DATA, AND MODEL

3.1 Methods

We aim to investigate to what extent the change in ESG CSI data of an underlying equity holding is linked to additional investment by SWFs in these holding.

Our empirical strategy to test our hypothesis is based on an estimation of logit regression. We take the change in investor holdings and estimate the model with a binary dependent variable (1 for investment, 0 for no further investment and disinvestment). The model assumes among other assumptions that the observations should be unrelated to each other. In words the occurrence of one observation should not have any influence on the occurrence of another. Additionally it is assumed that there is a linear relationship between the variables and the log odds of the dependent variable. We will assess this assumption by conducting exploratory data analysis and plotting the variables against the log odds of the variable. Moreover it is important to have no multicollinearity among the variables. Multicollinearity refers to a situation where two or more independent variables are highly correlated with each other which can lead to estimates. We will evaluate this assumption by examining a correlation matrix. Furthermore we have ensured a large sample size for our analysis. Having a sufficient number of number of observations to predictor variables helps ensure that our parameter estimates are stable, and our inferences are reliable.

An econometric approach is used to quantify the impact of independent variables on the investment decision of SWFs.

We utilize the software SAS Studio 3.81 which is an integrated development environment (IDE) offered by SAS Institute for managing data conducting analysis and programming.

3.2 Data

We take the biggest SWFs as investors, ranked by total assets under management (AuM) (SWF Institute, 2023b), and define a minimum level of relevance at AuM $\geq$ USD 25bn as of 31 December 2021. These criteria allow us to rank 1–32 out of 97 total SWFs. As presented in Tab. 1, the total AuM coverage of the selected SWFs is 95% of all SWF AuM and 96% of all SWF public equity holdings. Amongst those 32 SWFs, public equity holdings are officially available for 24 SWFs (Refinitiv/LSEG data). This is a total AuM coverage of 87% of all SWF AuM and 94% of all SWF public equity holdings. AuM data is derived from the Sovereign Wealth Fund Institute (SWFI).

To further focus our analysis on the most significant ESGI change cases, we consider the following: first, we analyze the involvement of the aforementioned 24 SWFs in ten public equity holding special events/scandal cases, e.g., British Petroleum (2010), Volkswagen (2015), and Boeing (2019). Involvement is defined as investment and disinvestment in at least 1 out of 10 investments during 2007–2022.

Second, we derive from the scandal case single events the following seven scandal case industries: pharmaceuticals and biotechnology, automobiles and parts, support services (industrial goods and services), oil and gas, food and beverage, chemicals, and banks.

This leads us to the final set of eleven SWFs for the analysis, as outlined in Tab. 2.

As presented in Tab. 3, the final sample of selected eleven SWFs account for 62% of total global SWF AuM and 71% of all SWF public equity holdings.

Tab. 1: Sample of SWFs by AuM

	AuM (USDT)	**% of all SFW AuM**	**Public equity holdings (USDT)**	**% of all SWF public equity holdings**
Ranked 1–32 (out of 97) with total AuM $\geq$ USD 25bn	8.42	95%	3.38	96%
24 (out of 32) with available public equity holding data	7.70	87%	3.30	94%

Sources: Refinitiv/LSEG, SWF Institute

Tab. 2: Focus SWFs for further analysis

#	**Name**	**Abbreviation**	**Country**
1	Government Pension Fund Global / Norges Bank Investment Management	GPFG	Norway
2	China Investment Corporation	CIC	China
3	Abu Dhabi Investment Authority	ADIA	United Arab Emirates
4	Kuwait Investment Authority	KIA	Kuwait
5	SAMA Foreign Holdings	SAMA	Saudi Arabia
6	GIC Private Limited (Government of Singapore Investment Corporation)	GIC	Singapore
7	Temasek Holdings	Temasek	Singapore
8	National Social Security Fund	NSSF	China
9	Korea Investment Corporation	KIC	Korea
10	Alberta Investment Management Corporation	Alberta	Canada
11	(Texas) Permanent School Fund	PSF	USA

Sources: Refinitiv/LSEG, SWF Institute

Tab. 3: Sample SWF by AuM

	AuM (USDT)	% of all SWF AuM	Public equity holdings (USDT)	% of all SWF public equity holdings
Ranked 1–32 (out of 97) with total AuM ≥ USD 25bn	8.42	95%	3.38	96%
24 (out of 32) with available public equity holding data	7.70	87%	3.30	94%
11 (out of 32) for analysis of CSI awareness regarding enlarged scandal case industry scope	5.52	62%	2.50	71%

Sources: Refinitiv/LSEG, SWF Institute

3.3 Model

3.3.1 Variables and Descriptive Statistics

The relationship between equity holding investments and our explanatory factors is investigated with the application of a logit model. Our binary dependent variable Y (1 for investment, 0 for no further investment and disinvestment) is represented by the change in the number of stocks in the underlying public equity holding. Our study uses objective indicators to measure firms' ESG data, which is based on external evaluation of the firms. We deploy the RepRisk dataset, which tracks media coverage of incidents influencing the ESG performance of firms. Our main control variable is represented by the ESG CSI by one lag (ESGI_{t-1}) factor which is an objective measure of CSR performance delivered by RepRisk and specifically the RepRisk Index (RRI). The ESGI is followed by a set of additional independent firm-specific variables describing financial performance.

ESGI serves as an indicator measuring how attention the media and stakeholders give to ESG matters. The ESGI calculation considers factors, including the reach of information sources how when ESG risk incidents occur and the nature of those incidents. These factors are analyzed to determine and quantify challenges faced by a company based on its ESG performance and impact. The severity and uniqueness of these issues are also taken into consideration. This information is then used to generate a risk score, which helps companies prioritize their efforts, in addressing ESG risks. However, unlike some tools used to assess risk, the ESGI does not consider the order in which incidents occur. This means that it does not prioritize incidents based on their sequence. In our study we utilize the ESGI that considers the significance of ESG risk incidents. It focuses on how a company or project has been exposed to a specific ESG risk. The ESGI places emphasis, on exposed companies and projects because they are more responsive to exposures compared to those, with extensive past exposure.

The approach utilized in this scenario remains consistent regardless of whether the problem falls under the categories of Environment (E), Social (S), or Governance (G). The significance assigned to ESG concerns is not influenced by factors such, as industry or country. The ESGI approach does not differentiate between E, S or G elements. Instead, it calculates based on the connections a company has with all combined E, S or G issues. This methodology enables us to gauge a company's level of involvement with ESG matters without focusing on E, S or G components. The main objective of this methodology is to assess a company's performance in terms of ESG by considering its engagement with social and governance issues without any bias, towards sectors or countries.

When assessing a company's ESG performance it is crucial to recognize that ESG breakdowns should not be utilized for comparing companies. Instead, their primary purpose is to monitor how a company's ESG exposure evolves over time. Relying solely on ESG breakdowns for comparisons can be misleading due to variations in reporting standards and ESG factors among companies. Therefore, it is advisable to utilize ESG breakdowns as a tool, for examining the progress and enhancements in a company's ESG performance than directly comparing it with entities.

The ESGI score is measured on a scale of zero, to 100 with a score indicating risk exposure, for the company. Tab. 4 shows the different ESGI ranges that categorize these scores.

Tab. 4: ESGI ranges and corresponding risk exposure

ESGI ranges	Risk exposure
0–25	low risk
26–49	medium risk
50–59	high risk
60–74	very high risk
75–100	extremely high risk

Sources: RepRisk

It is anticipated that the ESGI for most large multinational organizations will fall within the range of 26–50, given their extensive global footprint and associated exposure to various ESG risks. Tab. 5 (see page 13) presents all the variables, including definitions and summary statistics that we use in our model.

All variables are consistently lagged by one year. Focus variables for ESG CSR and CSI are additionally lagged by two years related to one year lag. This will additionally lead to better understanding, more accurate estimation, and improved forecasting of economic relationships and phenomena.

The change in ESG CSI represented by the *Difference in ESG CSI*, $\text{DESGI}_{(t-2,t-1)}$, tells us about the annual change in the company's ESGI, calculated as the difference between the lagged values $t-1$ and $t-2$. The $\text{DESGI}_{(t-2,t-1)}$ can be positive or negative. A positive $\text{DESGI}_{(t-2,t-1)}$ means that the ESGI has grown from $t-2$ to $t-1$, and a higher ESGI means increased risk. A negative $\text{DESGI}_{(t-2,t-1)}$ means that the ESGI has decreased from $t-2$ to $t-1$, representing decreased risk, which can be considered to positively affect an investment in public equity holdings, i.e., an additional investment. To the best of our knowledge, this effect has not been examined in the literature and is the core of our analysis. Research conducted by Wurster and Schlosser (2021) highlights a significant finding that cannot be ignored. The evidence they uncovered indicates that SWFs investment in public equity holdings has a profound impact on the decisions made by other investors. The power that SWFs wield in corporate decision-making and resource deployment causes significant changes in the holdings of other investors year by year.

The *Overall ESG Corporate Social Responsibility* by one lag, ESGR_{t-1}, tells us about ESG ratings that are to a large extend based on company self-reported CSR information and published in CSR reports. The LSEG database (former Refinitiv) defines the ESGR score as an overall company evaluation based on publicly available company self-reported information (LSEG, 2024). According to LSEG, the main sources of information are annual reports, company websites, stock exchange filings, CSR reports, NGO websites, and news sources (LSEG, 2024). The score measures three categories Environmental, Social, and Governance, all of which are intended to generate long-term shareholder value. We will use ESGR as a metric of a company's sustainability performance. The ESGR scores range from 0 (lowest) to 100 (highest).

Tab. 6 shows the LSEG ESG Scores including score ranges, quartiles, and description.

Liang and Renneboog (2020) provide compelling evidence that SWFs consider ESGR factors when taking ownership stakes in listed companies, and they consider the level of past ESGR performance as well as recent ESGR score improvement when making investment decisions. Moreover, the study identifies a positive relationship between SWFs' ESGR considerations and target firms' ESGR performance, suggesting that the integration of ESGR factors could result in better ESGR performance for target firms. These findings demonstrate the need for SWFs to prioritize ESGR considerations in investment decisions. The findings suggest that SWFs with a clear ESG policy or those that prioritize transparency are more likely to incorporate ESGR factors into their investment decisions. Additionally, SWFs originating from developed countries, or countries with civil law origins, tend to place higher importance on ESGR considerations. However, the study did not find significant changes in ESGR scores for firms with SWF ownership stakes, based on analysis of two scandal cases.

Tab. 5: Description of variables and summary statistics

Variable	Code	Description	Mean	Median	Maximum	Minimum	Skewness	Kurtosis	Standard Deviation	Number of Observations	Source
Investor's Holdings	Y	Number of shares held as of the report date (split adjusted as of feed date)	8,713,589.07	0.00	2,760,000,000.00	0.00	17.06	392.24	73,715,363.04	16,520	Refinitiv/LSEG
ESG Corporate Social Irresponsibility	ESGI_{t-1}	Company's risk exposure (by one lag)	11.38	1.00	80.00	0.00	1.40	1.86	14.71	16,520	RepRisk (RRI)
Change in ESGI	$\text{DESGI}_{(t-2,t-1)}$	Change in the company's risk exposure; ESGI per year; calculated by the difference between the lagged values $(t-2)$ and $(t-1)$	0.64	0.00	67.00	−42.00	−2.00	13.71	10.13	14,160	RepRisk (RRI)
Overall ESG Corporate Social Respon-sibility	ESGR_{t-1}	Overall company ESG score based on company self-reported CSR information in the environment (by one lag)	32.56	30.90	94.92	0.00	0.31	−1.28	29.57	16,518	Refinitiv/LSEG
Change in ESGR	$\text{DESGR}_{(t-2,t-1)}$	Change in the company's ESG figure; ESGR per year; calculated by the difference between the lagged values $(t-2)$ and $(t-1)$	0.00	0.00	88.83	−94.11	−2.00	13.70	14.60	16,518	Refinitiv/LSEG
Company Market Capitalisation	CAP_{t-1}	Value of company's market capitalisation (by one lag)	9.11	9.78	14.92	0.00	−2.39	4.89	2.96	16,520	Refinitiv/LSEG
Dividend Yield	DIV_{t-1}	The annual dividend per share divided by the stock's price per share (by one lag)	1.59	0.92	167.42	0.00	27.37	1,449.58	2.88	16,520	Refinitiv/LSEG
Sales Growth	SG_{t-1}	Growth of sales (by one lag)	602.53	4.78	6,423,450.00	−139.40	107.90	12,268.63	54,239.43	16,520	Refinitiv/LSEG
Return on Assets	ROA_{t-1}	Net income divided by total assets (by one lag)	3.96	3.71	2,709.44	−1,352.71	41.37	3,992.73	31.27	16,519	Refinitiv/LSEG
Return on Equity	ROE_{t-1}	Net income divided by shareholder equity (by one lag)	5.89	10.90	12,159.90	−7,988.45	−2.09	814.41	246.55	16,519	Refinitiv/LSEG
Market to Book Ratio	MTB_{t-1}	Market capitalisation divided by total book value (by one lag)	2.28	1.96	896.78	−1,111.26	−26.29	1,037.86	29.39	16,520	Refinitiv/LSEG

Sources: Refinitiv/LSEG, RepRisk

Tab. 6: LSEG ESG Scores

Score range	Quartile	Description
0 to 25	First Quartile	Scores within this range indicates poor relative ESG performance and insufficient degree of transparency in reporting material ESG data publicly.
$>$ 25 to 50	Second Quartile	Scores within this range indicates satisfactory relative ESG performance and moderate degree of transparency in reporting material ESG data publicly.
$>$ 50 to 75	Third Quartile	Scores within this range indicates good relative ESG performance and above average degree of transparency in reporting material ESG data publicly.
$>$ 75 to 100	Fourth Quartile	Score within this range indicates excellent relative ESG performance and high degree of transparency in reporting material ESG data publicly.

Sources: LSEG (2024)

The change in ESG CSR represented by the *Difference in ESG CSR*, $\text{DESGR}_{(t-2,t-1)}$, tells us about the annual change in the company's ESGR, calculated as the difference between the lagged values $t-1$ and $t-2$. The $\text{DESGR}_{(t-2,t-1)}$ can be positive or negative. A positive $\text{DESGR}_{(t-2,t-1)}$ means that the ESGR has grown from $t-2$ to $t-1$, and a higher ESGI means a better ESG factor according to LSEG ESG Scores as outlined in Tab. 6. A negative $\text{DESGI}_{(t-2,t-1)}$ means that the ESGI has decreased from $t-2$ to $t-1$, representing a lower ESG factor.

The *Company Market Capitalization* by one lag, CAP_{t-1}, refers to the value of a company's market capitalization. It serves as an indicator for SWF investment in public equity holdings. Market capitalization plays a role in investment decision making overall. Investors often rely on market capitalization to gauge the size of a company and determine whether it falls under cap mid cap or small cap stocks. Different investors may prefer investing in companies of varying sizes depending on their investment objectives risk tolerance and strategies (Wagner, 2013). Companies that are included in these indexes benefit from increased visibility and credibility, which can lead to increased investor interest and demand for their stock. As most SWFs invest in market indices, it is unrealistic to broadly exclude market index companies from their portfolios. Liang and Renneboog (2020) find no clear evidence for a positive relation between CAP and ownership. In some cases, this relationship is positive, but in some negative, depending on the econometric model chosen (the Hackman Model and the Probit Panel Random-Effects Model).

The *Dividend Yield* by one lag, DIV_{t-1}, refers to the dividend per share divided by the price per share of the stock. Considering DIV is crucial when making investment choices. DIV represents the portion of a company's stock price that is distributed to shareholders as dividends. Stocks that pay dividends can offer investors an income stream which is important for those seeking to generate income like retirees. DIV also serves as an indicator of a company's return on investment (ROI) for shareholders. A higher dividend yield indicates a return on investment which appeals to investors seeking returns. A company's capability to distribute dividends consistently and maintain a dividend yield indicates its wellbeing. When companies regularly pay dividends it usually signifies that they have a cash flow, robust earnings, and a long-term growth strategy. This makes them more appealing as investment options. Dividend paying stocks are often considered suitable for long-term investments due to the stability and predictability of dividend payments. These payments provide investors with a sense of security. According to Liang and Renneboog's study in 2020, there is evidence suggesting that higher levels of equity holdings dividends influence the ownership stakes of SWFs in these companies.

The *Sales Growth* by one lag, SG_{t-1}, refers to the ratio of dividend per share to the price per share of a stock. It serves as an indicator of a company's revenue generation capability. When sales increase it signifies that there is demand for the company's products or

services which can lead to profits and a positive outlook for its performance. Additionally, SG can also indicate a company's ability to gain market share. If a company can boost its sales in a market it may be gaining market share from its competitors, which is seen as a sign for investors. Furthermore, SG offers insights into a company's growth potential. Companies that consistently demonstrate sales growth over time may have an edge in the market and possess robust growth strategies making them potentially attractive investment opportunities. SG can also be an indicator of broader industry trends. If a company's sales are increasing in an industry that is also experiencing growth, it may be an indication that the company is well-positioned to capitalize on industry trends. Liang and Renneboog (2020) find positive evidence that SG influences SWF ownership of these companies. Wurster and Schlosser (2021) reveal that a rise in ownership by SWFs leads to a decline in market value, operating performance, and investment efficiency of target companies. These results align with the viewpoints presented by Bortolotti et al. (2015), which propose the political agenda hypothesis and passive investor hypothesis. According to these theories, SWF investments in target companies are linked to declining performance and sales growth in the subsequent three years. Additionally, having a SWF on the board of directors is linked to more significant SWF discounts, ultimately having an adverse effect on firm value. Bortolotti et al. (2015) found that the median SG of SWF equity investments was lower than the SG of a benchmark sample.

The *Return on Assets* by one lag, ROA_{t-1}, which is calculated by dividing a company's net income by its total assets, is widely regarded as a critical indicator used to determine whether to invest in public equity holdings. This measure is considered a valuable predictor that helps to make informed investment decisions. ROA gauges a company's efficiency in generating profits relative to its assets, which can be a sign of management competence. Liang and Renneboog (2020) find positive evidence that ROA influences SWF ownership. This theory is supported by empirical findings of Bortolotti et al. (2015), who found that the median ROA of SWF equity investments is higher than the ROA of a benchmark sample.

The *Return on Equity* by one lag, ROE_{t-1}, is a financial metric of a company's net income in relation to its shareholder equity, and it is a vital predictor used by SWFs to evaluate the potential gains of investing in public equity holdings. This metric helps to make informed investment decisions by providing insights into a company's profitability and overall financial health. Like ROA, ROE can be used to compare a company's performance to its peers in the same industry. Companies with a higher ROE may have a competitive advantage or a more efficient business model, which can make them a more attractive investment option. A higher ROE can also imply a higher return on investment for shareholders. Liang and Renneboog (2020) find positive evidence that ROE influences SWF ownership of these companies.

Finally, the *Market to Book Ratio* by one lag, MTB_{t-1}, is a measure used to guide investment decisions in traded companies. It compares a company's market value to its book value which represents the worth of its assets after subtracting liabilities. Assessing the MTB ratio helps determine if a company is undervalued or overvalued. A lower MTB ratio indicates undervaluation presenting an investment opportunity while a higher MTB ratio suggests overvaluation and may not be an investment option. Furthermore, analyzing the MTB ratio provides insights into a company's growth potential. A lower MTB ratio could indicate that the market has yet to recognize the growth prospects of a company whereas a higher MTB ratio might imply that the market has already factored in its growth potential. According to Liang and Renneboog (2020) there is no evidence supporting any correlation between SWFs ownership of public equity holdings and the MTB ratio. In fact, depending on the model used (such as the Hackman Model or Probit Panel Random Effects Model) this relationship can exhibit tendencies. Bortolotti et al. (2015) found that the median MTB of SWF equity investments was higher than the MTB of a benchmark sample.

3.3.2 Model Specification

The relationship between equity holding investment and explanatory factors was investigated with the application of a logit model in Eq. 1.

$$\begin{aligned}\ln\left(\frac{p_i}{1-p_i}\right) = \beta_0 &+ \beta_1\,\mathrm{ESGI}_{t-1} + \\ &+ \beta_2\,\mathrm{DESGI}_{(t-2,t-1)} + \\ &+ \beta_3\,\mathrm{ESGR}_{t-1} + \\ &+ \beta_4\,\mathrm{DESGR}_{(t-2,t-1)} + \\ &+ \beta_5\,\mathrm{CAP}_{t-1} + \\ &+ \beta_6\,\mathrm{DIV}_{t-1} + \\ &+ \beta_7\,\mathrm{SG}_{t-1} + \\ &+ \beta_8\,\mathrm{ROA}_{t-1} + \\ &+ \beta_9\,\mathrm{ROE}_{t-1} + \\ &+ \beta_{10}\,\mathrm{MTB}_{t-1}\end{aligned} \tag{1}$$

The model was estimated with the binary dependent variable $Y = 1$ if an investment took place or $Y = 0$ if there was no change in the equity holding position or disinvestment. Explanatory variables used in the model are described in Tab. 6. The model was optimized using a stepwise backward elimination method whereas the initial model included all variables. The least significant variable was consequently eliminated in every next step. The results interpreted in this paper include the conclusion of the backward elimination with significant variables only. Variable DESGI was left in the model despite its insignificance because the influence of this variable was subject to the conducted analysis. Model parameters were estimated with Fisher scoring method which is equivalent to iteratively reweighted least squares. To obtain robust estimates and reduce possible bias was applied bias-reducing penalized maximum likelihood fit. Pre-analysis included also diagnostic test to check for the correlation across explanatory variables (Tab. 7), but no significant correlations were found.

The relationship between the estimated coefficients and probability of equity holding investment was not linear and was obtained using formula:

$$p_i = \frac{1}{1+\mathrm{e}^{-x}},$$

where

$$\begin{aligned}x = \beta_0 &+ \beta_1\,\mathrm{ESGI}_{t-1} + \beta_2\,\mathrm{DESGI}_{(t-2,t-1)} + \\ &+ \beta_3\,\mathrm{ESGR}_{t-1} + \beta_4\,\mathrm{DESGR}_{(t-2,t-1)} + \\ &+ \beta_5\,\mathrm{CAP}_{t-1} + \beta_6\,\mathrm{DIV}_{t-1} + \beta_7\,\mathrm{SG}_{t-1} + \\ &+ \beta_8\,\mathrm{ROA}_{t-1} + \beta_9\,\mathrm{ROE}_{t-1} + \beta_{10}\,\mathrm{MTB}_{t-1}\end{aligned}$$

The estimated probability was used to verify the prediction ability of the model. If the predicted probability was smaller than 0.5 it was considered as predicted 0. If the predicted probability was 0.5 and higher it was considered as predicted 1. The explanatory power of the model was expressed as the number of concordant and discordant predictions in comparison with real-world data. The global hypothesis about the overall significance of the model was verified using the likelihood ratio and Wald criteria.

In the results, the odds ratios were interpreted instead of the estimated model parameters as they were linearly related with odds and were derived from the model parameters according to Eq. 2.

$$\text{odds ratio} = \frac{\text{odds}\,(x_j+1)}{\text{odds}\,(x_j)} = \mathrm{e}^{\beta_j} \tag{2}$$

The interpretation is that odds in favor of purchase multiply by e^{β_j} with each unit increase of x_j. Interval estimate for odds ratio was based on Wald confidence limits.

3.3.3 Limitations

This study comes with some limitations. First, we focused on scandal case industry holdings and did not consider the full portfolio of public equity holdings of the selected SWFs. We deem this a minor problem as we concentrated on the main industries from a CSI point of view (e.g., automobile, oil and gas, chemicals, and food and beverage). Nevertheless, it might have been beneficial to evaluate the full portfolio to give a holistic answer to our main research questions and to add more industry perspectives. Second, we concentrated on SWFs both with an appropriate number of public equity holdings that can be analysed and that invested in scandal case holdings. In most cases, other liquid (e.g., fixed income) and espe-

Tab. 7: Pearson Correlation Coefficients, Prob > |r| under $H_0 : \rho = 0$

	ESGI$_{t-1}$	**DESGI$_{t-1}$**	**ESGR$_{t-1}$**	**DESGR$_{t-1}$**	**CAP$_{t-1}$**	**DIV$_{t-1}$**	**ROA$_{t-1}$**	**MTB$_{t-1}$**	**ROE$_{t-1}$**	**SGT$_{t-1}$**
ESGI$_{t-1}$	1.0000	0.0966***	0.5618***	0.0879***	0.2998***	0.1711***	0.0084	−0.0281***	0.0097	0.0173**
		< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	0.2791	0.0003	0.2100	0.0254
DESGI$_{t-1}$	0.0966***	1.0000	0.0002	0.0114	0.0081	0.0078	−0.0049	0.0069	0.0149	0.0030
	< 0.0001		0.9727	0.1741	0.3323	0.3523	0.5619	0.4101	0.0764	0.7182
ESGR$_{t-1}$	0.5619***	0.0003	1.0000	0.2472***	0.4167***	0.2224***	0.0261***	−0.0159**	0.0442***	0.0176**
	< 0.0001	0.9727		< 0.0001	< 0.0001	< 0.0001	0.0008	0.0406	< 0.0001	0.0234
DESGR$_{t-1}$	0.0879***	0.0114	0.2472***	1.0000	0.1381***	0.0014	0.0220***	−0.0126	0.0036	0.0067
	< 0.0001	0.1741	< 0.0001		< 0.0001	0.8583	0.0047	0.1052	0.6416	0.3884
CAP$_{t-1}$	0.2998***	0.0082	0.4167***	0.1381***	1.0000	0.1756***	0.0720***	0.0216***	0.0227***	−0.0269***
	< 0.0001	0.3323	< 0.0001	< 0.0001		< 0.0001	< 0.0001	0.0054	0.0035	0.0005
DIV$_{t-1}$	0.1712***	0.0078	0.2224***	0.0014	0.1756***	1.0000	0.0333***	−0.0032	0.0198**	0.0006
	< 0.0001	0.3523	< 0.0001	0.8583	< 0.0001		< 0.0001	0.6855	0.0111	0.9424
ROA$_{t-1}$	0.0084	−0.0049	0.0261***	0.0220***	0.0720***	0.0333***	1.0000	−0.0022	0.0765***	−0.0044
	0.2791	0.5619	0.0008	0.0047	< 0.0001	< 0.0001		0.7783	< 0.0001	0.5731
MTB$_{t-1}$	−0.0281***	0.0069	−0.0159**	−0.0126	0.0216***	−0.0032	−0.0022	1.0000	0.0464***	−0.0018
	0.0003	0.4101	0.0406	0.1052	0.0054	0.6855	0.7783		< 0.0001	0.8131
ROE$_{t-1}$	0.0098	0.0149*	0.0442***	0.0036	0.0227***	0.0198**	0.0765	0.0464***	1.0000	0.0006
	0.2100	0.0764	< 0.0001	0.6416	0.0035	0.0111	< 0.0001	< 0.0001		0.9436
SGT$_{t-1}$	0.0174**	0.0030	0.0176**	0.0067	−0.0269***	0.0006	−0.0044	−0.0018	0.0006	1.0000
	0.0254	0.7182	0.0234	0.3884	0.0005	0.9424	0.5731	0.8131	0.9436	

Note: statistical significance at $\alpha = 0.001$ (***), $\alpha = 0.05$ (**), $\alpha = 0.1$ (*) level.
Sources: SAS output on Refinitiv/LSEG and RepRisk data

cially illiquid/private market investments (e.g., private equity and infrastructure) by SWFs are currently undisclosed and non-transparent (Déséglise and Freijido, 2019; Fotak et al., 2016; Gangi et al., 2019). It is important to mention that we could have used alternative models and setups. However, these may have resulted in certain disadvantages. For instance, we could reduce our sample size to avoid missing values for some of our independent variables. This could potentially produce stronger results, but the number of observations would have been significantly lower. Finally, we did not use dynamic models in our analysis, which means we did not include the lagged values of the endogenous variable.

4 RESULTS AND DISCUSSION

The model suggests that the purchase of stocks is significantly influenced by variables ESGI$_{t-1}$, ESGR$_{t-1}$, CAP$_{t-1}$, DIV$_{t-1}$, ROA$_{t-1}$, and MTB$_{t-1}$ (Tab. 8). The overall significance of the logit model was verified by the likelihood ratio and Wald test, both with p-value < 0.0001, which means that the model is significant. The explanatory power of the model was evaluated by the number of concordant predictions which were equal to 66.1%. The results suggest that the variable that most influences the purchase of a stock is CAP$_{t-1}$. For every unit increase in CAP$_{t-1}$, the odds in favor of stock purchase rise by 15%. The estimated influence of CAP$_{t-1}$ on odds is between 12.8% and 17.2%. The second most influential variable, according to the odds ratio estimates, is DIV$_{t-1}$, which for each unit increase the odds in favor of stock purchase rise by 2.8%. The estimated influence on odds is between 0.9% and 4.7%. The third most influential variable, according to the odds ratio estimates is ESGR$_{t-1}$, which for each unit increase the odds in favor of stock purchase rise by 1.1%. The estimated influence on odds is between 0.9% and 1.2%. The influence of other variables on the purchase of a stock is smaller: ESGI$_{t-1}$ by 0.9%, ROA$_{t-1}$ by 0.3%,

Tab. 8: Model results

Variable	Coefficient	Standard Error	Wald Chi-Square	Pr > ChiSq	Odds ratio point estimate	95% Wald Confidence Limits	
Intercept	−2.175***	0.089	591.800	< 0.001	–		
$ESGI_{t-1}$	0.009***	0.001	40.780	< 0.001	1.009	1.007	1.012
$ESGR_{t-1}$	0.010***	0.001	204.560	< 0.001	1.011	1.009	1.012
CAP_{t-1}	0.139***	0.0100	204.610	< 0.001	1.150	1.128	1.172
DIV_{t-1}	0.027***	0.009	8.570	0.003	1.028	1.009	1.047
ROA_{t-1}	0.003**	0.001	4.910	0.027	1.003	1.000	1.005
MTB_{t-1}	0.001**	0.001	4.090	0.043	1.001	1.000	1.002
$DESGI_{(t-2,t-1)}$	0.001	0.002	0.350	0.553	1.001	0.998	1.004
$DESGR_{(t-2,t-1)}$	0.005	0.002	0.056	0.813	1.000	0.996	1.005

Note: statistical significance at $\alpha = 0.001$ (***), $\alpha = 0.05$ (**), $\alpha = 0.1$ (*) level.
Sources: SAS output on Refinitiv/LSEG and RepRisk data

and MTB_{t-1} by 0.1%. The estimated odds ratios and their confidence limits are compared in Tab. 8.

The variables ROE_{t-1}, $DESGR_{(t-2,t-1)}$, $DESGI_{(t-2,t-1)}$, SG_{t-1}, and were eliminated from the model as insignificant, i.e., not significantly affecting the probability of stock purchase. Fig. 1 shows the comparison of $DESGI_{(t-2,t-1)}$ distribution in both categories of the dependent variable. The plots show maximum and minimum values, and the box is created by the 1st and 3rd quartile. Values outside the minimum and maximum can be considered outliers. The average and median $DESGI_{(t-2,t-1)}$ are similar in both categories. Hence, there is no significant difference in $DESGI_{(t-2,t-1)}$ of the compared categories. This implies that $DESGI_{(t-2,t-1)}$ does not significantly affect the binary dependent variable. This was confirmed also by results from the estimated logit model.

According to applied logit regression to create predictive model, Tab. 9 provides information on the post-hoc test of the final model in terms of, e.g., predictive accuracy, sensitivity, and specificity.

Tab. 9: Association of Predicted Probabilities and Observed Responses

Percent Concordant	66.1	Somers' D	0.323
Percent Discordant	33.8	Gamma	0.323
Percent Tied	0.0	Tau-a	0.158
Pairs	49053400	c	0.661

Sources: SAS output on Refinitiv/LSEG and RepRisk data

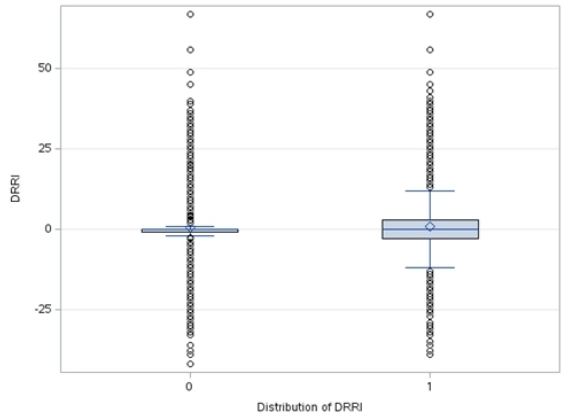

Fig. 1: Boxplot comparison of $DESGI_{(t-2,t-1)}$ in the 0 and 1 categories of Y
Sources: SAS output on Refinitiv/LSEG and RepRisk data

In our data set, CAP_{t-1} plays a more important role than $ESGR_{t-1}$ for SWF investment decision-making. This contrasts with Liang and Renneboog (2020), who find no clear evidence for a positive relationship between CAP_{t-1} and ownership. In some of their analyzed cases, this relationship is positive but in some it is negative, depending on the econometric model chosen. The difference in significance of company market capitalization may depend on the scope of industries chosen. Our data set concentrates on industries selected from former reputational risk scandal cases. Furthermore, our results are consistent with the findings of Liang and Renneboog (2020) for DIV_{t-1}. They find that a higher DIV_{t-1} of public equity holdings influences the ownership decisions of SWFs. In our data set, DIV_{t-1} plays an important role for the investment decision. The annual dividend per share paid has a signal effect for the capital strength of a company, especially for those investors who have a broad and diversified equity portfolio. In addition, Liang and Renneboog (2020) find positive evidence that ROA_{t-1} influences SWF ownership decisions. This theory is supported by the empirical findings of Bortolotti et al. (2015), who found that the median ROA of SWF equity investments was higher than the ROA of a benchmark sample. The results of our sample show that the purchase of stocks is significantly influenced by ROA_{t-1}. Furthermore, Liang and Renneboog (2020) find no clear evidence for a positive relationship between MTB and ownership. In some cases, this relation is positive but in some also negative, again depending on the econometric model chosen. Bortolotti et al. (2015) found that the median MTB of SWF equity investments was higher than the MTB of a benchmark sample. Our results show that there is a positive relationship between MTB_{t-1} and stock ownership. It seems that for the scandal case data set chosen for our analysis, SWFs see a value in MTB_{t-1} for the market valuation and growth potential of related public equity holdings. In contrast to the findings of Liang and Renneboog (2020) for SG_{t-1} and ROE_{t-1}, as well as Bortolotti et al. (2015) for SG, the variables SG_{t-1} and ROE_{t-1} were eliminated from our model as insignificant, i.e., they do not significantly affect the probability of stock purchase. This may be a result of the different scope and focus of our analysis.

Our findings related to Corporate Social Responsibility support earlier research showing a trend among SWFs to consider ESG practices of their portfolio companies when making investment decisions using ESG data that is to a large extend company self-reported (Liang and Renneboog, 2020). The model results show that $ESGR_{t-1}$ is statistically significant on an $\alpha = 0.01$ level. For every unit increase in $ESGR_{t-1}$, the odds in favour of stock purchase rise by 1.1%. The estimated influence of $ESGR_{t-1}$ on odds is between 0.9% and 1.2%. However, the coefficient for $ESGR_{t-1}$ is lower than those of CAP_{t-1} and DIV_{t-1} as both are the most dominant variables related to a purchase of public equity holdings by SWFs in scope of this analysis.

Our results regarding the consideration of Corporate Social Irresponsibility measures revealed by the media are various and need to be separated between last available ESG CSI data, $ESGI_{t-1}$, and past changes in ESG CSI data from $t-2$ to $t-1$, $DESGI_{(t-2,t-1)}$.

Regarding $ESGI_{t-1}$, the results show that $ESGI_{t-1}$ is statistically significant on an $\alpha = 0.01$ level. For every unit increase in $ESGI_{t-1}$, the odds in favour of stock purchase rise by 0.9%. The estimated influence of $ESGI_{t-1}$ on odds is between 0.7% and 1.2%. However, the coefficient of $ESGI_{t-1}$ is lower than the coefficient of $ESGR_{t-1}$ which means that company self-reported ESG CSR data has more influence on the purchase of public equity holdings of SWFs than negative reputation risk ESG CSI data purely derived from independent sources. In addition, the standard deviation of $ESGI_{t-1}$ is higher than for $ESGR_{t-1}$. It seems obvious that SWFs still consider company self-reported CSR information (ESGR) more than public CSI data (ESGI), including changes in reputation risk (DESGI), in their investment decisions regarding public equity holdings. However, this may just be a timing effect. Some years ago, SWFs started to include

ESG data based on self-reported information in their investment decision-making process for sustainability reasons. Farag et al. (2022) examined the effect of SWFs on corporate ESG reputation risk. Their research uncovered a significant positive impact of SWF ownership on the reputation risk associated with ESG factors. Their results are in accordance with the theories on the effect of institutional investors' ownership on firm ESG reputation risk. To expand their corporate governance framework, SWFs in turn may take the opportunity to look closely at reputation risk figures tracked from media coverage of incidents influencing the ESG performance of firms. What we cannot read from the data is if this effect is the same (1) for every ESGI range (from 0 to 100; Tab. 4), (2) for corresponding risk exposure (from low risk to extremely high risk; Tab. 4), and (3) for a switch of one ESGI range and corresponding risk exposure to another.

$\text{DESGI}_{(t-2,t-1)}$ and $\text{DESGR}_{(t-2,t-1)}$ were eliminated from the model as insignificant and therefore do not significantly affect the probability of stock purchase. Both are defined as past changes of ESG data from $t-2$ to $t-1$, $\text{DESGI}_{(t-2,t-1)}$ for Corporate Social Irresponsibility and $\text{DESGR}_{(t-2,t-1)}$ for Corporate Social Responsibility. Hence, a change in past ESG data of underlying public equity holdings does not seem to have a significant effect on an investment into the underlying holding – at least within the scope of this analysis. This is an interesting observation as SWF take past ESG data into account when deciding for a purchase into public equity holdings but may not consider past changes in ESG data on a statistically significant level.

Question is, if this is because financial company data are still a predominant reason for a purchase or – even worse – is it because SWFs just go the half mile in "walking the talk" on ESG matters? We will not be able to completely answer these questions here but would instead rather open the academical discussion. While the one group of SWFs like KIC from Korea, GPFG from Norway, and CIC from China have the highest ESG evaluation scores the SWFs group around ADIA from UAE, SAMA from Saudia Arabia, and NSSF from China have the lowest. Hence, ESG behaviour very much depends on what scope of investors is in focus of the analysis. Some may just be equity investors to make money and to maximize the return of their investments.

Based on the summary of empirical analysis, H_1 null "There is no influence of public equity holding Corporate Social Irresponsibility data on the investment decision of SWFs regarding public equity holdings." can be rejected. Hypothesis 1 is accepted which means that "Public equity holding Corporate Social Irresponsibility data has a pronounced influence on the investment decision of SWFs". Additionally, H_2 null "The influence of public equity holding Corporate Social Irresponsibility data on the investment decision of SWFs is higher than the influence of company self-reported CSR information." can be rejected. Hypothesis 2 is accepted which means that "The influence of public equity holding Corporate Social Irresponsibility data on the investment decision of SWFs is not higher than the influence of company self-reported CSR information". The research question "Are SWF sensitive to ESG CSI data when considering an investment in public equity holdings?" can be affirmed.

5 CONCLUSIONS AND OUTLOOK

SWFs are some of the most significant and formidable global institutional investors, along with pension funds and insurance companies. Although their investment behavior has been subjected to numerous research studies, their individual investment decisions across various asset classes remain mostly obscure. Nonetheless, their substantial influence on the sustainability of economies cannot be ignored, as SWFs significantly impact the corporate landscape and social welfare (Capapé, 2018). The inquiry at hand pertains to the level

of concern exhibited by SWFs regarding the sustainability of their investments and the underlying factors that drive their responsible behavior. Our research contributes to the literature on the impact of CSI factors on the investment decision-making process of SWFs, particularly in relation to their investments in publicly traded equity holdings. To measure the CSI associated with individual firms, we utilized an objective indicator based on external evaluations of the target companies. Specifically, we employed the RepRisk dataset, which monitors media coverage of incidents affecting the ESG performance of firms.

It appears evident that SWFs still prioritize company self-reported CSR information over publicly available independent CSI data expressed by reputation risk figures in their investment decision-making process concerning publicly traded equity holdings. If this turns out to be true, there is need for a greater ESG integration into SWF investment strategies and call for a promotion of sustainable investing practices not limited to liquid assets to showcase a sustainable "walk the talk". However, this may simply be a matter of timing. In previous years, SWFs began incorporating ESG data derived from self-reported information into their investment decision-making process due to sustainability considerations. Thus, we suggest that SWFs and other investors incorporate external CSI indicators as a preliminary measure for present and future investments. This explicitly includes the recommendation to also make use of past changes to ESG CSI data regarding a change in reputation risk. This approach should be expanded to include not only publicly traded equity holdings but also other liquid investments such as fixed income securities, as well as illiquid investments such as private equity and infrastructure. Notably, these types of investments are often undisclosed and non-transparent, yet increasingly feature sustainability elements and labels, making the inclusion of external CSI indicators particularly important. The analysis of SWF investment behavior in relation to ESG assets provides important insights into their investment strategies and decision-making processes. The results of our study suggest that SWFs are increasingly considering ESG factors when making investment decisions, but there is still room for improvement. Policymakers and stakeholders can use these findings to encourage greater ESG integration in SWF investment strategies and promote sustainable investing practices more broadly.

This study comes with some limitations. First, we focused on scandal case industry holdings and did not consider the full portfolio of public equity holdings of the selected SWFs. We deem this a minor problem as we concentrated on the main industries from a CSI point of view (e.g., automobile, oil and gas, chemicals, and food and beverage). Nevertheless, it might have been beneficial to evaluate the full portfolio to give a holistic answer to our main research questions and to add more industry perspectives. Second, we concentrated on SWFs both with an appropriate number of public equity holdings that can be analyzed and that invested in scandal case holdings. In most cases, other liquid (e.g., fixed income) and especially illiquid/private market investments (e.g., private equity and infrastructure) by SWFs are currently undisclosed and non-transparent (Déséglise and Freijido, 2019; Fotak et al., 2016; Gangi et al., 2019). It is important to mention that we could have used alternative models and setups. However, these may have resulted in certain disadvantages. For instance, we could reduce our sample size to avoid missing values for some of our independent variables. This could potentially produce stronger results, but the number of observations would have been significantly lower. Finally, we did not use dynamic models in our analysis, which means we did not include the lagged values of the endogenous variable.

Our study aimed to contribute to the existing literature while offering a new perspective by adding CSI factors as a main variable for the investment decision of SWFs to invest into public equity holdings. Based on our results, we can offer some suggestions for future research and improvement. Special research should be performed on the sensitivity of the socio-economic environment and financial market

events on the ESG CSI behavior of SWFs. Additionally, a special view could specifically be spent on the influence of ESG CSI and ESG CSR data on the sell-behavior of SWFs related to public equity holdings. We only made use of static models for our analysis. In future research we suggest including the dependent variable as an independent variable with one period lagged to test if the past values of SWF holdings affect the model results. Thus, dynamic models can be used. Specifically, a Generalized Method of Moments (GMM) or Maximum Likelihood (ML) estimator can be used to regress the dynamic panel datasets.

Common holding data, particularly self-reported ESG data, continues to be a significant factor in the investment decision-making process. The transparency of reputation risk changes (positive and negative) should – as a pre-indicator – help decision-makers to enhance sustainability in their portfolios (Hentov and Petrov, 2017; Stone and Truman, 2016). Reputation risks within a portfolio should be avoided due to price effects based on bad reputation risk factors. Hence, in a bad reputation risk scenario, there shouldn't be any investment at all, or an earlier-as-market-sell could help to protect the reputational risk value of a portfolio. To adequately capture the effects of reputation risk, longitudinal studies are needed, which can bridge the gap between scientific research and the practices of individual SWFs as well as initiatives such as the One Planet Initiative, International Forum of Sovereign Wealth Funds, and the Sovereign Wealth Fund Institute. In addition, future studies should analyze investment behavior and CSI factor consideration in relation to concrete profit-and-loss calculation and statistic forecasting balance sheet management. This might also be considered in future research on whether the investment behavior of SWFs is equivalent to that of other major investors, such as insurance companies and public pension schemes (Blundell-Wignall et al., 2008; Boubakri et al., 2016). This should not be limited only to public equity holdings but should also consider additional liquid asset classes, e.g., fixed income and public real estate, as well as private market investment such as infrastructure equity and debt and real estate.

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