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The effect of national ESG score on greenhouse gas emissions, moderated by quality of government

Author: Robert-Jan Schuuring
Student number: 566553
Thesis supervisor: Hou, W
Second reader: Bliek, R de
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ABSTRACT

This study looked at the effects of national ESG score on greenhouse gas emissions, further analysing the relationship with quality of government as the mediator. Using a panel data set of 43 countries from 1990 to 2020, a fixed-effects model was used to regress national ESG scores against greenhouse gas emissions. This study finds that national ESG score has a positive effect on greenhouse gas emissions and that quality of government has a negative moderation effect. However, the effect of national ESG score is not significantly different from zero. This would mean, given future results are significant, that improving national ESG score through policy could result in an increase of greenhouse gas emissions.

Keywords: national ESG score, emissions, quality of government

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CHAPTER 1 Introduction

With climate change becoming more of a problem as time passes, governments adopt different policies to limit their contribution to this problem. Take for example the EU approval of zero-emission cars sold after 2035 (Sadden, 2023). These policy changes are most often categorized as environmental, social, or governance, giving rise to the ESG score of a country (Jiang et al., 2022). Left up to debate is whether these policy changes have the desired effect, let alone any effect at all. For regulations to have any positive effect, they would have to cause a reduction in greenhouse gas emissions (GHG), the leading cause of global warming (Cassia et al., 2018). There would be no point in making green policy should this not be the case. With the world looking to be as sustainable as possible through agreements like the Paris Accords, it can be said that it is essential that national ESG scores have a substantial effect on the reduction of greenhouse gas emissions.

Previous research has shown that there is indeed a significant effect of national ESG scores on the emission of greenhouse gasses (Long & Feng, 2024). By running a fixed-effect OLS regression the authors show that collectively ESG scores do have a negative effect. Should you separate the score into the three different categories (Environmental, Social, Governance), only governance is found not to be significant. An interesting finding considering that the results can be used for future policy making. The authors also ran an analysis with an interaction term between ESG score and environmental policy stringency, which also has a significant effect. This is line with other smaller research, such as the effect of innovation (Kurshid et al., 2022) or construction of infrastructure (Wei et al., 2021). Furthermore, the study by Long & Feng introduce corruption as a control variable. While there is no clear consensus on the effect of corruption on greenhouse gas emissions, there seems to be a negative relationship between a countries level of corruption and its green innovation performance (Wen et al., 2023). After all, corruption is linked to a government's ability to pass policy. Should we as the world want more effective policy, corruption seems to be a factor worth looking at, especially in lower-income countries (Rose-Ackerman, 2008).

Other research has suggested Quality of Government (QoG) having an influence on emissions. Simionescu, Strielkowski, and Gavurova (2022) found that the quality of a government contributes to environmental quality, especially in the long run. To be more specific, statistics such as regulatory quality and control of corruption have been used to measure the quality of government. Regulatory quality and corruption both affect the amount and effectiveness of ESG policy that a country might pass. As such, it is possible that the effect of a high national ESG score is diminished by a low quality of government. Since environmental policy stringency, the moderator that Long & Feng (2024) used, is related to the quality of government there is reason enough to look further into the relationship. Therefore, this paper will integrate the quality of government acting as a moderator for national ESG scores when looking into greenhouse gas emissions. However, the main aim of this paper is to answer the following question: How do national ESG scores affect greenhouse gas emissions?

To attempt to answer the above question this study will run a fixed-effects regression, using a dataset of 43 countries from 1990 to 2020 using yearly data. Both datasets for greenhouse gas emissions and ESG scores are selected from The World Bank ESG dataset, and the data to quantify quality of government is selected from The Quality of Government Institute (University of Gothenburg). While the measurement of greenhouse gas emissions is relatively straightforward (equivalent of CO2 in metric tons), measuring a countries' ESG score and quality of government is not. To give countries a score for ESG this study will use the entropy weight method proposed by Jiang et al. (2022). This method applies a weight to several variables that will be selected to represent the ESG score. An example of such an indicator would be energy use (in kg of oil equivalent per capita). To measure quality of government I used the score given by the International Country Risk Guide. This variable ranges from 0 to 1, with 1 indicating high quality of government. Furthermore, several control variables are considered. These variables can be categorized as general demographic (education, population) and macro-economic (GDP, FDI, exports and imports).

Just like with Long & Feng, the expected result is first and foremost that national ESG score will have a negative, significant effect on the emission of greenhouse gasses. Secondly, the interaction term between ESG score and quality of government is expected to be negative as well. The results will shed more light on the importance of governments in the constant battle with emissions and make the quality of government clearer in terms of its effect on climate change. However, it is very likely that questions will remain about the actual effects of ESG scores. For instance, there will be some parts of the variance of greenhouse gasses that will not be explained by either ESG scores alone, or a model with quality of government as a moderator. Furthermore, since both ESG scores and the scores for quality of government will represent a lot of separate variables, there will be no specification on which variable has a larger effect than the others. For example, we might look at 20 different environmental variables to represent the environmental part of the ESG scores. It could be the case that one of those 20 variables explains most of the variance, which we would not know: although it is given a weight, exact significance cannot be traced back without further research. This implies that the study will leave questions open for further investigation.

This study has found that national ESG scores have a positive effect on GHG emissions; increasing the ESG score would lead to an increase in GHG emissions. This result is in stark contrast to the expected result. The effect of the moderator (quality of government) was found to be negative; under a high quality of government increasing national ESG score through policy leads to a decrease in GHG emissions. This would mean that environmental, social, and governance policy only has an inhibiting effect on global warming if the quality of the government passing the policy is high. This would suggest that improving the quality of government is a priority.

The remainder of this paper is structured as follows: section 2 looks at past literature and reviews existing theories, section 3 discusses the data and collection method, section 4 discusses the used method, section 5 discusses the results and how they compare to existing literature, and section 6 focuses on concluding the study and providing limitations.

CHAPTER 2 Theoretical Framework

2.1 National ESG Score

To understand the relationship between ESG scores and GHG emissions, a concrete definition of ESG score needs to be made. While research into national ESG score is still in a developmental stage, the term has been coined much earlier to rate how sustainable and ethical companies are in terms of environmental, social, and governance regulations. Initially a measure for responsible investment, ESG is considered a strategy that investors could use to judge corporate behaviour (Li et al., 2021). Academic definitions for national ESG score are similar, labelling ESG as the international standard for measuring the degree of sustainability and green development (Jiang, 2024). ESG ratings for companies are given by different agencies, each using their own method of rating. On the other hand, national ESG score is a new method that can be used to determine how sustainable a country is, and more importantly what they are doing to contribute to sustainability using the different indicators. The score is built from different indicators reflecting a more objective measurement of sustainability when compared to a companies' given rating.

ESG was first introduced into literature through its social aspect by Coleman (1988) through the concept of social capital and how it could add to firm value as a counterclaim to earlier thoughts that social responsibility had negative financial implications. This idea was propagated further by Elkington (1998) with "the triple bottom line", where he argued that financial, environmental, and social factors should be included in firm value calculations. This would lead to several journal articles such as by Ballou et al. (2003) and Sinkin et al. (2008) that would show that improving social and environmental aspects of a firm could increase its value. Advocacy for employee welfare and the already upcoming issue of climate change led researchers to stack up these values against the value of the firm, with the common result that both could benefit. Literature surrounding national ESG score, one that is attributed to a single country, has only developed in the recent years. Jiang (2022; 2024) and Long & Feng (2023; 2024) have explored the effects that national ESG scores can have on different national measures, such as green innovation which can be influential on national policy making.

2.2 Relationship between ESG score and greenhouse gas emissions

While the macro-effect of ESG performance has little research on it, there are more results that can be discussed in terms of micro-effects. Li & Xu (2024) look at the effect of corporate ESG ratings on the reduction of carbon emissions using Chinese listed companies from 2010 to 2020. They conclude that a higher ESG rating promotes a reduction in corporate carbon emissions. Cong et al. (2022) also look at the same effect using Chinese companies but separate them in different regions. This results in the same conclusion only being applicable to western and central regions of China, while no effect can be found for the eastern regions. On the contrary, Wang et al. (2023) find a positive relationship between corporate ESG score and carbon emissions, both in the long and short term for firms in China. The authors attribute this to transparency and efficiency problems in the ESG investing landscape. Taking the effect to global stage, Long & Feng (2024) find a negative relationship between national ESG scores and greenhouse gas emissions per country. They argue that the different factors that make up the national ESG score such as agricultural production, public health, and innovation have a direct effect on greenhouse gas emissions. Splitting up the different pillars of ESG allows for other research perspectives.

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Environment - A large proportion of greenhouse gas emissions is caused by energy consumption (Waheed et al., 2019; Al-mulali et al., 2013). Since most of energy consumption come from the burning of fossil fuels, an increase in renewable energy would have a negative effect on GHG emissions. Dong et al. (2019) explores whether this relationship is true. While not significant, they do find that there is a negative effect of renewable energy consumption on the emission rate based on data of 120 countries over 20 years. The main cause of insignificance in the coefficient is likely because fossil fuel consumption has also increased over time. An increase in investment into renewable energy and thus renewable energy consumption would then likely result in a decrease in emissions. Reay et al. (2012) looked at global nitrous oxide emissions because of agriculture, finding a large portion of emissions being caused by recycled nitrogen such as from manure. Interestingly, the authors find that emissions may be greatly reduced through more efficient nitrogen use, changing diet, and decreasing food waste.

Social – Social factors can have very contrasting effects on the GHG emission rate. The study by Wang & Li (2021) looks at the threshold effect of different social factors in 154 countries over the timespan of 24 years. They find that an aging population, population density, and the life expectancy all inhibit the amount of carbon emissions. The inhibition increases even further when the threshold has been reached for population age and life expectancy, but when population density increased beyond its threshold this inhibition effect decreases. A possible explanation for this is that while carbon emission-reducing infrastructure such as public transport become more efficient, the extra fossil fuel consumption from more housing and public services dominates the inhibiting effect. In terms of (transportational) infrastructure, literature is clear that there is a positive relationship between construction and emissions (Xie et al., 2017; Müller et al., 2013). The effect of income inequality on carbon emissions is less pronounced. Grunewald et al. (2017) find that in low-income economies, income inequality is negatively correlated with carbon emissions, while there is a positive correlation between the variables in high-income economies. Jorgenson et al. (2017) find the same result for the different US States, but they are not significant. A possible explanation being that the low-income population is out of the carbon loop in low-income economies.

Governance – There has also been research on several governance factors that influence emission rate. Oyewo (2023) looks at the effect of corporate governance on carbon emission performance for 336 multinational enterprises over the span of 15 years. The author looks at different variables and finds that some multinationals have a positive relationship with emission rate, while others have a negative relationship. Mensah et al. (2018) find that in most OECD countries innovation using patents and research & development lead to a decrease in carbon emissions. The sign of this effect can however change per country when looking at whether residents or non-residents are responsible for the patents. Alola (2019) also finds a positive relationship between net migration, measured with the migration index, and carbon emissions. This relationship follows other literature in the effect of urbanization on carbon emissions, which can be linked back to population density. The combination of the listed variables and the supporting literature provides enough scientific theory to state the first hypothesis:

H1: National ESG score will have a negative effect on the emission of greenhouse gasses.

2.3 Quality of government

For any successful policy on development, whether that would be social or environmental, a good quality of government is of great importance (Holmberg et al., 2009). While the definition of quality of government is debateable, Kaufmann et al. (1999) defines it as the following: "the traditions and institutions by which authority in a country is exercised. This includes (1) the process by which governments, are selected, monitored and replaced, (2) the capacity of the government to effectively formulate and implement sound policies, and (3) the respect of citizens and the state for the institutions that govern economic and social interactions among them." As such quality of government measures the quality of national institutions and their ability to function. While limited for developed countries, there is more than enough research on the effect of quality of government on carbon emissions for developing countries. Gani (2012) finds through regressions that multiple indicators falling under quality of government have a negative coefficient with carbon emissions per capita for developing countries. Karim et al. (2022) find the same relationship, this time in a sample of sub-Saharan countries. On the contrary, Le & Ozturk (2022) and Obobisa et al. (2022) find a positive relationship between QoG and carbon emissions in developing countries and African countries respectively. The authors suggest that the governments in their sample focus more on economic growth, leading to more carbon emissions, rather than cutting their emission rate. In terms of the moderating effect, since ESG measures the effects of government policy it can be theorized that a higher QoG would result in a stronger effect of ESG on GHG emissions, whatever this effect may be. This leads to the second hypothesis:

H2: Quality of government will amplify the decreasing effect that ESG will have on greenhouse gas emissions.

CHAPTER 3 Data

3.1 Sample description

Data has been collected for 43 different countries from 1990 to 2020 (31 years) for a total of 1,333 observations. The data has been obtained from the World Bank and OECD databases, and the International Country Risk Guide (ICRG) through the Quality of Government institute. Out of the 43 countries in the sample, 34 are OECD members. While most continents are looked at, apart from Africa, the highest concentration of countries in the sample lie in Europe. This paper attempted to get a more varied sample by selecting countries varying in size (population, GDP) and thus amount of emissions.

3.2 Variables

The dependent variable is *GHG*, or total emission of greenhouse gasses including land use and forestry. The emissions are collected from the OECD database for N=43 countries and t=31 years (1990-2020). The total consists of the following gasses: carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulphur hexafluoride (SF6), and nitrogen trifluoride (NF3). All these gasses are converted to their CO2 equivalent and are then measured in thousands of tonnes. This variable is then transformed to its natural logarithm. As can be expected, emissions vary greatly between different countries. Notable is that emissions can vary quite a lot within countries as well (over time).

The independent variable is ESG, which is measured using the ESG index proposed by Jiang et al (2022). The ESG index is constructed using 55 different environmental, social, and governance indicators provided by the World Bank ESG database. The indicators are then each provided a weight according to the entropy weight method so that the final ESG index is calculated using an objective weighting method. It is worth nothing that the ESG scores are calculated using only the countries within the sample, instead of calculating the scores using all countries and then only taking the scores from the sample countries. Furthermore, to avoid a mechanical relationship between ESG score and GHG emissions all the emission indicators have been removed from the index. Indicators that are used for coming up with a QoG score have also been removed from the index to avoid a mechanical relationship with mediator. While the index has a range from 0 to infinity, all scores can be found between 0 and 1. The ESG index gives a score to a nations environmental, social, and governing policies using statistics. For this index, a higher score means that a country performs better in at least those three categories compared to other countries. Finally, the natural logarithm of index is taken to reduce right skewness and to make interpretation of results easier.

The other independent variable, or the mediator, is QOG, meaning Quality of Government. This variable is proxied by using the quality of government rating given out by the International Country

Risk Guide. Measuring quality of government objectively remains a challenge in literature. One method of measurement is using the different governance indicators provided by the World Bank Institute, as mentioned by Rodriguez-Pose & Di Cataldo (2014). Using the same method as with the ESG index, one could establish a QOG index. Another method developed by the Quality of Government institute with the help of Charron et al. (2014) is the regional European Quality Index. This index is created using survey questions aimed at locals instead of experts to get a more realistic grasp at perceived quality. The questions are organized in three different pillars; quality, impartiality, and corruption. However, the index only guarantees data for the European regions. Because of that lack in data for different continents, this paper measures quality of government as provided by ICRG. The ICRG measures quality of government using similar pillars as the survey by Charron et al.: corruption, law and order, and bureaucracy quality. The index has a range from 0 to 1, with 1 representing the highest quality of government. Because of missing data in the early years of the sample, 1,254 observations have been collected. While European countries could be thought of as having the highest quality of government in the world, there are quite a few observations that can refute this claim. QoG is cubed to reduce the left skewness in the sample.

3.3 Control variables

This paper also introduces multiple control variables to account for omitted variable bias. All control variables have been collected from the World Bank databases. Observation count is mentioned per variable, with no mention meaning data was collected for the whole sample.

Research has shown that international trade has a positive effect on emissions, both globally and when looking at trade between specific countries (Li & Hewitt, 2008; Kozul-Wright & Fortunato, 2012). Furthermore, there is a mechanical effect of international trade on the ESG score because of trade indicators. To proxy international trade the paper incorporates both national Exports and Imports measured in millions of constant 2015 US dollars. For both the natural logarithm is then taken to account for right skewness. A total number of 1,297 observations has been collected, with beginning years (1990-1995) missing for some countries.

While its effect on emissions is debated in literature, foreign direct investment (FDI) is also incorporated in the regression. While some theory suggests that FDI should lead to an increase in emissions, multiple papers have come out suggesting that there is either no effect or that this relationship is in fact negative (Pazienza, 2019; Demena & Afesorgbor, 2019; Zhu et al., 2016). FDI is measured using net inflows based on the balance of payments in current US dollars. Net inflows are calculated as investments received from foreign entities minus possible payments that those entities receive. To allow for easier data analysis, the natural logarithm of FDI is then taken. A total number of 1,297 observations has been collected, with beginning years (1990-1995) missing for some countries.

Additionally, the Population of a country is also considered. Theoretically, the more people there are in a country the more greenhouse gasses they should emit. This is backed up by literature (Dietz &

Rosa, 1997). Population is measured as the amount of people that are living or residing in the country of question. The natural logarithm is then taken to account for right-skewness.

Furthermore, *GDP* especially when measured per capita has also been shown to have a positive effect on emissions (Tucker, 1995). Tucker does also show that for higher incomes the amount of emissions decrease, which could leave interesting results in this paper's regression. GDP is measured by GDP per capita and then the natural logarithm is taken to account for right skewness. A total number of 1,300 observations has been collected, with beginning years (1990-1995) missing for some countries. Lastly, the paper also looks at the effect of Education on emissions. The consensus in literature supports the claim that an increase in investment in education quality leads to a decrease in emissions (Wang et al., 2022; Yao et al., 2020). However, this effect is not always significant. Education is proxied by gross secondary enrolment rate, as this is likely to give the most varied statistics when compared to primary and tertiary enrolment rate. The data collected is not complete for every country in the sample, with a total observation count of 1,208.

3.4 Summary statistics

Table 1: Summary statistics

Variable	**N**	**Mean**	**St. Dev**	**Min**	**Max**
GHG	1,320	11.502	1.705	4.399	15.726
ESG	1,333	-2.085	0.253	-2.671	-1.209
QOG	1,254	0.525	0.300	0.029	1
Exports	1,297	11.385	1.441	7.976	14.714
Imports	1,297	11.338	1.438	8.055	14.955
FDI	1,297	12.751	0.395	-0.643	13.878
Population	1,333	16.211	1.570	12.448	19.619
GDP	1,300	9.930	0.894	7.184	11.630
Education	1,208	103.921	15.624	49.823	164.080

Table 1 shows that the summary statistics are straightforward. The maximum of Education lies above a 100% because there are people enrolled in secondary education that are not in the age group considered to correspond to secondary education. This however has no impact on how the variable should be read, where a higher percentage means better education. With the mean above 100%, most of the countries in the sample can be considered to have "good" education.

CHAPTER 4 Method

To analyse the collected data this paper will make use of a panel fixed-effects regression model. While originally both the fixed effects and the random effects model have been considered, through the Hausman test it has been determined that a fixed-effects model is more appropriate. The fixed-effects model considers all unobserved characteristics that are fixed over time and between countries and removes them from the error term. Essentially the model controls for the unobserved fixed effects by incorporating them into the model. While the model could be applied only for time-invariant or individual-invariant effects, the model this paper employs will account for both. The fixed-effects model differs from a pooled regression in this account, since the pooled regression has the fixed effects in the error term. Hence, the first model looks as follows:

$$GHG_{i,t} = \alpha + \beta ESG_{i,t} + \delta CV_{i,t} + Country + Year + \varepsilon_{i,t}$$

Where GHG denotes the greenhouse gas emissions over time (t) and countries (i). Alpha represents the constant, and ESG denotes the national ESG score. CV denotes the combination of the control variables, and Country and Year represent the unobserved effects of their respective dimension. Lastly, epsilon represent the error term. The second model, which answers the second hypothesis, looks similar:

$$GHG_{i,t} = \alpha + \beta_1 ESG_{i,t} + \beta_2 QOG_{i,t} + \beta_3 ESG_{i,t} * QOG_{i,t} + \delta CV_{i,t} + Country + Year + \varepsilon_{i,t}$$

Where QOG denotes the quality of government and ESG*QOG the interaction term between ESG score and quality of government. All the other terms are the same as with the first model.

The final model(s) that will be looked at split the ESG score into separate environmental, social, and governance scores. The models look identical to the models shown above with the minor difference being that ESG gets replaced by one of the subfactor scores (E, S, or G). This also applies to the interaction term. All models have clustered errors to reduce heteroskedasticity.

CHAPTER 5 Results & Discussion

5.1 Effect of national ESG score on GHG emissions

Both models 1 and 2 in Table 2 are run using a panel regression, with the third model applying country and year fixed effects. The coefficient of model 1 indicates that there is a positive effect of national ESG score on GHG emissions, with a 1% increase in ESG score leading to a 0.0637% increase in GHG emissions. However, the coefficient is not statistically significant from 0. Model 2, which incorporated the control variables, finds a negative effect of national ESG score on GHG emissions. However, the coefficient is still not significant. There is a significant effect found in FDI, Population, and GDP, which follow the expected relationships with GHG emissions. In the third model the effect of national ESG score is once again positive and still not significantly different from 0. The effect is larger by several magnitudes compared to the effect measured in the first two models. While not significant, the coefficients for exports and imports are negative suggesting an increase would lead to a decrease in emissions. An increase in FDI, Population, GDP, and Education all result in an increase of GHG emissions, with only GDP and Education being significantly different from 0. The effect of Education has a different sign than expected, even if the measured effect is incredibly small. Because of the method of calculating the national ESG score it is not possible to have a score of 0, thus the constant is not interpretable.

Table 2: The effect of national ESG score on GHG emissions

	(1) GHG	(2) GHG	(3) GHG
ESG	0.0637	-0.0456	0.169
	(0.176)	(0.175)	(0.145)
Exports		-0.0797	-0.0148
		(0.204)	(0.196)
Imports		-0.282	-0.135
		(0.207)	(0.238)
FDI		0.0119^{*}	0.00417
		(0.006)	(0.005)
Population		1.176^{***}	0.889
		(0.106)	(0.558)
GDP		0.633^{***}	0.694^{***}
		(0.217)	(0.233)

Education		0.00272	0.00476**
		(0.002)	(0.002)
_cons	11.61***	-10.32***	-8.109
	(0.467)	(2.603)	(9.004)
N	1320	1134	1134
R^2			0.150

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Because the results of Table 2 contrast some of the findings found in literature the ESG index has been separated into its three separate pillars to analyse their effect on GHG emissions in Table 3. All models were run with the fixed effects method. First, all the coefficients of the pillars are nog significantly different from 0. The environmental and governance pillars have a positive effect on GHG emissions, while the social pillar has a negative effect. The control variables behave very similarly as with Table 2, so no additional explanation is required.

Table 3: The effect of pillar score on GreenHouse Gas emissions

	(1)	(2)	(3)
	GHG	GHG	GHG
Exports	-0.0118	0.0107	-0.0294
	(0.197)	(0.205)	(0.204)
Imports	-0.129	-0.144	-0.119
	(0.237)	(0.247)	(0.255)
FDI	0.00327	0.00496	0.00288
	(0.005)	(0.005)	(0.006)
Population	0.840	0.935	0.892
	(0.584)	(0.570)	(0.558)
GDP	0.683***	0.644**	0.549**
	(0.234)	(0.239)	(0.240)
Education	0.00483**	0.00439**	0.00413**
	(0.002)	(0.002)	(0.002)
E	0.209		
	(0.140)		
S		-0.0802	
		(0.098)	

G			0.291
			(0.186)
_cons	-7.114	-9.169	-5.846
	(9.562)	(9.208)	(9.010)
N	1134	1134	1134
R^2	0.153	0.150	0.163

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

5.2 Moderation effect of Quality of Government

For the moderation effect the same models were used, but with the coefficient of QoG and the interaction term included. The coefficient of QoG is –2.246, meaning that there is a negative relationship between QoG and GHG emissions. However, this coefficient is not significantly different from 0. The interaction term is also negative, meaning that ESG has an inhibiting effect on GHG emissions in the presence of QoG. The interaction term is significant at the 10% level. For all models, the interaction term has the opposite sign of the ESG or ESG pillar component coefficient. The interaction term between environment and QoG is –0.924, implying the sema relationship as with the national ESG interaction term. The interaction term between the social pillar and QoG is positive, with a coefficient of 0.327. This would indicate that under higher QoG, social policy would lead to more GHG emissions. Lastly, as with the environmental pillar and the national ESG score, the interaction term of the governance pillar is negative with a coefficient of –0.215. This indicates the same relationship of decreasing GHG emissions under higher QoG.

Table 3: The moderation effect of QoG on the effect of ESG score on GHG emissions

	(1) GHG	(2) GHG	(3) GHG	(4) GHG
ESG	0.452			
	(0.280)			
QOG	-2.246	-2.440	1.271	-0.698
	(1.365)	(1.736)	(1.145)	(0.801)
ESG*QOG	-1.103*			
	(0.627)			
Exports	-0.0352	-0.0344	-0.0322	-0.0552
	(0.195)	(0.195)	(0.202)	(0.202)
Imports	-0.239	-0.245	-0.253	-0.217
	(0.284)	(0.275)	(0.299)	(0.309)

FDI	0.00139	0.00343	0.00295	-0.000442
	(0.003)	(0.004)	(0.005)	(0.004)
Population	0.914	0.754	0.830	0.905
	(0.591)	(0.621)	(0.607)	(0.626)
GDP	0.942***	0.975***	0.935***	0.790**
	(0.304)	(0.298)	(0.307)	(0.358)
Education	0.00442**	0.00446**	0.00460**	0.00435**
	(0.002)	(0.002)	(0.002)	(0.002)
E		0.468		
		(0.339)		
E*QOG		-0.924		
		(0.643)		
S			-0.213	
			(0.206)	
S*QOG			0.327	
			(0.303)	
G				0.317
				(0.204)
G*QOG				-0.215
				(0.201)
_cons	-9.029	-6.417	-9.229	-7.085
	(9.159)	(10.255)	(9.584)	(9.645)
N	1105	1105	1105	1105
R^2	0.172	0.170	0.164	0.175

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

5.3 Discussion

The results contrast the first hypothesis and the findings of Long & Feng (2024) and Li & Xu (2024) in terms of national ESG score and corporate ESG score. On the other hand, they are like the results of Wang et al. (2023) and Cong et al. (2022). These papers employed the following methods respectively: fixed-effects, staggered difference-in-differences, STIRPAT, and two way fixed-effects. While these models are very similar, the differences between them may lead to different results. This can be seen by the different coefficient signs of model 2 and 3 in Table 2. There can be several reasons for this difference in results. This study has removed the mechanical effect of emissions incorporated in ESG score, which might have removed a critical part of the relationship between ESG score and GHG emissions. A theoretical reason for the positive effect could be that the increase in national ESG score is found in variables that would increase GHG emissions as well. In this case, governments had less focus on green improvement. An example of this is the indicator measuring area of land used for agriculture. While an increase of this indicator is seen as positive in the perspective of ESG, more agriculture will lead to more GHG emissions (Reay et al., 2012). Furthermore, as stated by Dong et al. (2019), while the statistics reflect greener policy and more renewable energy, the energy consumption from fossil fuels has also increased. This could lead to a positive and insignificant coefficient in terms of the environmental pillar. In terms of the social pillar, while lacking significance, the negative effects seem to have dominated the positive effects. The heaviest weight in the social pillar is attributed to human life expectancy factors, which is in line with the results of Wang & Li (2021) results in decreasing GHG emissions. Another interesting result is the positive coefficient of education. While there is the consensus in literature that education inhibits carbon emissions, this result is not always significant. This study provides significant evidence that education results in more GHG emissions, at least in the studied sample.

In terms of the moderation effect, the results are similar to the findings of Gani (2012) and Karim et al. (2022), while directly contrasting the results of Ozturk (2022) and Obobisa et al. (2022). Since the coefficient is significant, it can be concluded that the coefficient is different from 0. The results of the interaction term do provide evidence of that under higher QoG ESG policy has more success in its aims. The reason for this effect can be because of numerous indicators making up QoG, just like with ESG, such as corruption (Gani, 2012). With a low QoG, there is a higher chance of corruption being present. That being the case, investments into ESG with the aim of decreasing GHG emissions could be thwarted and have the opposite effect. Furthermore, another reason could be the low to middle economy status that countries with lower QoG often have. These countries could have other priorities in ESG investment instead of a greener economy, leading to more GHG emissions. Compared to high QoG economies, where there is little to no corruption present and that have a developed enough economy to invest in greener policy, it is logical that low QoG cannot offset the positive effect that ESG has on GHG emissions. To answer the second hypothesis, the interaction suggests that QoG does not amplify the effect of ESG on GHG emissions, meaning we do not reject the second null hypothesis. It is however worth mentioning that should the first null hypothesis be rejected; we do reject the second null hypothesis. The combination of coefficients seems to suggest that under high QoG ESG will inhibit GHG emissions, while this effect is less certain with low QoG.

CHAPTER 6 Conclusion

This study has looked at the effect of national ESG score on GHG emissions, with QoG as a mediator. While ample research on corporate ESG is available, little is known about the effect of national ESG scores on GHG emissions. ESG is theorized to have great impact on global climate change, with countries looking to adopt policy that might be of help in reducing emissions. Should there be a direct cause, governments should know about it. Hence why this study attempts to answer the question: How do national ESG scores affect greenhouse gas emissions?

To answer the research, question a sample was taken of 43 countries from 1990 to 2020. Using a fixed effects model, national ESG score is found to have a positive effect on GHG emissions. However, this effect was not significantly different from zero. Additionally, the moderation effect that QoG has on the national ESG score is found be negative.

This study concludes that while its commonly thought that the effect of national ESG score on GHG emissions is negative, this does not have to be the case. There is reason to believe that this relationship is positive, which is also supported by other literature. Furthermore, the effect of having a higher QoG could dominate the positive effect that national ESG score has on GHG emissions. This would suggest that making increasing ESG score through policy would only be useful if the quality of government is high.

6.1 Limitations

To provide more conclusive results more data on the national ESG score would be needed. National ESG score is a new variable in literature with little research on it. Going of the entropy weight method, the World Bank data has done an amazing job collecting data for the different indicators. However, for a lot of countries/economies and years earlier than 1990 this data is not available yet. For future research either more data needs to be collected, or a different measure of national ESG score should be adopted to get objective results. The same could be mentioned for QoG, with a lot of data missing for lower-income economies.

The usage of the entropy weight method proposed by Jiang et al. (2022) is a great leap into analysing relationships with national ESG score, but still leaves rooms open for interpretation leading to validity problems. For instance, the method of making up for missing data and the bias given to p-values of zero are left unclear. This would lead to researchers calculating the index with slightly different methods. For future research, all parts of the method should be same for the method to be even more objective.

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