ERASMUS UNIVERSITY ROTTERDAM

Erasmus School of Economics

Master Thesis [MSc Strategy Economics]

ESG Scores and Firm Performance
: The Role of Board Member Diversity

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Abstract

The thesis highlights the role of ESG scores on firm performances and analyses the impact when board members' diversity factors of gender and nationality are included. It uses data from Refinitiv for ESG scores and BoardEx and Compustat – Capital IQ for other variables forming panel dataset. This study also chose four different types of ESG scores, ESG combined, E, S, and G pillar scores, to analyse what is the relevant pillar of ESG when general score shows insignificant result. Two models are used to analyse, first with fixed effects and then with IV regression to control for endogeneity. Fixed effects results did not prove hypotheses that ESG scores will have positive and significant improvement towards firm performances and the magnitude of improvement will increase when diversity factors are included. On the other hand, IV regression showed significant results that ESG combined, E and G pillar scores do have positive and significant effects to firm performances, and when diversity factors are included, then S pillar score improves firm performances when considered with ESG scores. Although limitations are recognized in model specification, the study derives significant role of ESG scores and which particular pillar of ESG is relevant towards a firm's diversity.

Keywords : ESG, firm performances, labour productivity, female ratio, nationality mix, fixed effects, IV regression

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Introduction

The role of environmental, social, governance (ESG) is increasing its value towards a firm's performance. In recent decades, there has been much research done whether ESG affects positively to a firm's financial performance or not, and some found that it does positively affect (Engle et al., 2021; Huppé, 2011; Van de Velde et al., 2005), and thus, the need for firms to put more efforts on ESG is rising. Since then, research to find out whether it is worth spending more money on ESG has been done, finding that higher ESG performance and corporate social responsibility (CSR) increases corporate outward foreign direct investment (Wang et al., 2024), reduces capital constraints (Cheng et al., 2013) leading to easier and higher access to finance (Lamont et al., 2001), and it creates firm value so that it is worth investing more money into it (Fatemi et al., 2015). However, although there are many studies on what the result of providing higher ESG within a firm is, there has not been much research done on what derives higher ESG that leads to higher firm performance. Therefore, this thesis will first assess the direct relationship between ESG scores and firm performance, and then, study the factors that impacts the relationship between ESG and firm performance.

A leading vendor of ESG scores, Refinitiv (Berg et al., 2021), defines ESG as a company's commitment and effectiveness across 10 main themes such as emissions, environmental product innovation, human rights, shareholders (LSEG, 2023). Specifically, the E pillar of *Environmental* measures how a firm deals with resources used, emissions, and the S pillar of *Social* measures commitment to workforce, human rights, community. Lastly, the G pillar of *Governance* measures management of a firm, shareholders and CSR strategy (LSEG, 2023). These pillars are also linked with the United Nation's Sustainable Development Goals (UN SDGs) which also brings important insight that ESG contributes to global sustainable growth solutions. To elaborate, Sharkar et al. (2023) analysed that ESG helps achieving UN SDGs and firms implementing CSR strategies that are in line with UN SDGs helps firms to gain competitive advantages to stakeholders and investors. They analysed that the E pillar is linked with SDG 13 (Climate Action), SDG 12 (Responsible Consumption and Production), the S pillar is linked with SDG 8 (Decent Work and Economic Growth), SDG 5 (Gender Equality) and SDG 10 (Reduced Inequalities), and the G pillar is linked with SDG 16 (Peach, Justice, and Strong Institutions) and SDG 9 (Industry, Innovation, and Infrastructure) (Sharkar et al., 2023). As each pillar of ESG contributes equally for a firm to obtain a higher total ESG score, taking care of improving each pillar for a firm is also important.

Specifically, this thesis would like to focus on the S pillar related SDGs for more detailed factors which are gender equality and reduced inequalities. As Sharkar et al. (2023) argued, implementing CSR strategies to meet the goal of gender equality and reduce inequalities will allow firms to gain competitive advantages to their stakeholders and investors leading to higher firm performances. Some scholars analysed that the inclusion of women in a firm's board is expected to improve social issues of inequalities in corporate strategy (Loop and DeNicola, 2019; Wasiuzzaman

and Wan Mohammad, 2019), and thus, this thesis will analyse using female ratio within a board to measure for how much is a firm positioning themselves regarding gender equality strategy. Furthermore, Gangi et al. (2023) analysed on the effect of cultural diversity of a board to a firm's social performance focusing on banking sector and found that cultural diversity positively affects towards social performance. However, not much research has been done to find on the impact of cultural diversity on firm's performance although it is an important factor to achieve UN SDGs goal of reducing inequality. Hence, this thesis will implement the nationality mix of a board to measure for firms' positioning of cultural diversity and find out the effect of it.

To address the impact of the ratio of females and the nationality mix in firms' boards, this thesis analysed using unbalanced panel data consisting of 5,038 listed firms from all over the world from 2013 to 2023. It includes four types of ESG scores of ESG combined, E pillar, S pillar, and G pillar scores to specifically find out the effects and female ratio and nationality mix data with several firm-specific control variables. Therefore, this thesis will be investigating on what is the impact of ESG scores on firm performances and does the impact vary when board member's diversity is considered.

This study provides new insights by analysing factors that interacts with ESG scores to improve firm performances in a global scale considering listed firms from all over the world. Most importantly, the second factor that this thesis will be considering, nationality mix, is a concept that is not explored much within the academics when analysing for the factors that influences firm performances. Thus, deriving the relationship between cultural diversity of a board on firm performances will contribute to putting Gangi et al. (2023)'s study one step forward. Lastly, this study also brings new way of controlling for endogeneity issue occurring when analysing the relationship with new instrumental variables.

Literature Review

Previous studies on the effects of ESG scores on firm performance

As previously discussed, there has been many prior studies on whether higher ESG scores and CSR increase firms' performances or not from various perspectives (Cheng et al., 2013; Fatemi et al., 2015; Lamont et al., 2001; Wang et al., 2024). While many studies show that having higher ESG scores lead to better firm performance, there are also counterarguments proving opposite relationship. Hence, the currently disclosed results of the effect of ESG scores on firm performance can be seen as mixture between positive and negative, affecting positively through certain factors and negatively through some others.

Veeravel et al. (2023) researched on whether the disclosure of ESG scores lead to superior firm performances or not. They used panel data set consisting of CNX NSE 500 index listed companies from 2010 to 2020 with the main dependent variables to measure for superior firm performance as Return on Assets (ROA) and Tobin's Q. They found that companies in higher quartile of ESG scores returned higher Tobin's Q, but unfortunately, lower ROA. As Veeravel et al. (2023) did, many studies used ROA and Tobin's Q as they can measure whether a firm is performing well from accounting perspective and also from market perspective (Kalash, 2021; Lee et al., 2014). On top of these two measures, Lee et al. (2014) also implemented Return on Equity (ROE) to measure for firm performance. They used data set consisting of Korean firms from 2011 to 2012, and found that there are positive and significant relationships between ROE and ROA and a firm's environmental responsibility performance. Furthermore, Cornett et al. (2016) analysed the same relationship in banking sector, and they also found that banks having higher CSR level were rewarded with higher financial performance. Interestingly, Kalash (2021) analysed whether higher environmental performance leads to higher stock prices, bringing different insight to measure for firm performance, and he concluded that environmental performance did not lead to higher stock prices but rather decreased, although it significantly increased ROA and ROE. Lastly, Nollet et al. (2015) analysed the relationship between Corporate Social Performance (CSP) and Return on Capital with the data of S&P500 firms from 2007 to 2011, and found significantly negative relationship between it. As such, although there have been different approaches to measure for firm performance, depending on studies and variables used, the relationship outcome varies.

As introduced, currently available papers studying on the effects of ESG scores on firm performance mainly uses ROA, ROE, Tobin's Q, and stock prices as an indicator for firm performance. However, another indicator that measures firm performance can be labour productivity. Settsu and Takashima (2020) did an analysis based on a long-term sectoral labour productivity data in Japan, and found that high labour productivity induced expansion of market economy in Tokugawa period (17-19th century) which led to continuous expansion in later periods. Furthermore, Lim and Lee (2008) analysed on the implication of labour productivity in Singapore and found that in late 1900s, labour productivity

was the main driving force of Singaporean economy. Lastly, productivity growth shows the efficiency and prosperity of economies (Tsiapa, 2023). Considering all, this thesis argues that labour productivity reflects how well is a firm currently performs, and thus, will be used as the indicator of firm performance.

Finally, although previous studies' results on the effects of ESG scores on firms' performances vary, this thesis will argue that it has positive effects as there were research done which proved that spending higher environment expenditure leads to better firm performance (Christmann, 2000; Clarkson et al., 2011; Clarkson et al., 2004; Hart, 1997; Johnston, 2005). This leads to the thesis' first hypothesis that firms having higher ESG scores will have better firm performance level.

Hypothesis 1 : *Higher ESG scores of companies will have a positive effect on their performances, ceteris paribus.*

Previous studies on the effects of gender diversity on ESG performance

Unlike the previous studies on the effects of ESG scores on firm performance, papers on the relationship between gender diversity and ESG performance showed consistent results that gender diversity within a firm positively affects ESG performance (Loop and DeNicola, 2019; Wasiuzzaman and Wan Mohammad, 2019). Lim and Chung (2021) conducted research on the effect of having female chief executive officer (CEO) on CSR. They used data set consisting of over 2,000 US companies, and concluded that companies with female CEO led to a higher and active participation in CSR. While Lim and Chung (2021) analysed based in US companies, Odriozola et al. (2024) analysed the relationship between ESG performance and gender diversity in European companies. They've used a data set consisting of four different countries' listed firms (Spain, France, Germany, and the United Kingdom) from 2002 to 2020. They also found that having a higher diversity in a board leads to a higher social and governance performance score. Similarly, Fayyaz et al. (2022) and Cucari et al. (2017) also used gender diversity within a company's board as an indicator for the gender diversity of a firm, and concluded that women in board affects positively towards ESG performance of a firm. Thus, since it is clear that gender diversity has positive effects on ESG performance of a firm from previous studies, this thesis will put one step further by analysing the effect of gender diversity on firm performance while also considering ESG performance of a firm. This leads to the second hypothesis of the thesis that having a higher proportion of female in a company's board will increase the magnitude of the positive effect of ESG scores on firm performance.

Hypothesis 2 : *Higher ESG scores of companies will have a positive effect on their performances and the magnitude will be more positive when there is higher proportion of female in a company's board, ceteris paribus.*

Previous studies on the effects of cultural diversity on firm performance

The effect of cultural diversity on ESG performance and firm performance is the least studied area among the three concepts that will be analysed in the thesis. Dodd et al. (2023) studied on the impact of board's cultural diversity on firm performance where cultural diversity is measured through ancestral root of directors. They found that having diverse board members lead for a firm to better perform in a competitive market that a firm tries more to innovate and be creative to gain competitive advantage. Also, Cheung and Lai (2023) researched on the influence of cultural diversity on ESG disclosure using firms in Hong Kong from 2010 to 2015. They found that having a diverse board improved social performance and business ethics within the company which is important for environmental and social performance to improve. Lastly, Martinez-Ferrero et al. (2020) studied on how does a board's cultural diversity affect on a firm's commitment to CSR level using Latin America companies data. They also found that firms having culturally diverse board were more inclined to be active on CSR which leads to better ESG performance. Thus, from previous studies, it is clear that how culturally diverse a firm is affects ESG performance positively, and as ESG performance affects positively to firm performances, cultural diversity of a board will also affect positively to firm performances. This leads to the thesis's third and last hypothesis that having a higher proportion of board members from different nationalities will increase the magnitude of the positive effect of ESG scores on firm performances.

Hypothesis 3 : *Higher ESG scores of companies will have a positive effect on their performances and the magnitude will be more positive when a board's nationality is more diversified, ceteris paribus.*

Data

Table 1 - Descriptive statistics

Variable	Description	Obs	Mean	Std. Dev.	Min	Max
Dependent variable						
Labour productivity	Revenue generated per employee	31,135	0.088	1.434	1.84e-06	97.674
Ln_labour_productivity	Log transformed labour productivity	31,135	-6.386	2.269	-13.208	4.582
Explanatory variables						
Esg_combined	Combined ESG scores from Refinitiv	29,625	48.452	19.327	.63	95.16
e pillar	Scores of Environmental pillar from Refinitiv	29,623	45.393	27.461	0	99.06
s pillar	Scores of Social pillar from Refinitiv	29,623	51.027	23.534	.15	98.4
g pillar	Scores of Governance pillar from Refinitiv	29,625	51.396	22.49	.47	98.7
female_ratio	Proportion of female in a board	41,261	.191	.15	0	.833=
nationality mix	Proportion of directors from different countries	37,693	.219	0.258	0	.9
Instrument variable						
HDI	Human Development Index by country	29,814	.864	.111	.51	.967
Historical value of female ratio	Average female ratio with the value from 1997 till 2 years before the base year (e.g. for year 2013, it is the average from 1997 till 2011, and for 2020, it is from 1997 till 2018)	36,049	.115	.11	0	.758
Historical value of nationality mix	Average nationality mix with the value from 1997 till 2 years before the base year. (Same as historical female ratio)	34,272	.195	.225	0	.848

Control variables						
Firm specific						
Average time in company	Average time a board member spent in the company (year)	41,262	8.084	5.614	0	44.071
Ln_avg_time_in_company	Log transformed average time in a board member spent in the company	41,184	1.845	.77	-2.303	3.786
Total assets	Total assets (billion)	38,591	28.338	149.149	0	3247.277
Ln_total_assets	Log transformed total assets per company	38,587	.941	2.116	-10.062	8.086
Firm age	Age of a firm	39,187	45.363	42.206	0	503
Ln_firm_age	Log transformed age of a firm	39,069	3.418	.952	0	6.221
ROA	Return on Assets calculated by Net income / Total assets	38,572	-.068	20.647	-4051.75	155.032
Ln_roa	Log transformed ROA	32,477	-3.218	1.138	-11.29	5.044
R&D Expenditure	R&D expenditure spent per firm	17,614	32478.578	477725	-.921	24929171
Ln_rnd_expenditure	Log transformed R&D expenditure spent	17,609	4.927	3.409	-6.908	17.032
Earnings per Share	Average Earnings per Share by industry	40,652	210.019	8548.086	-1324795	543716
Ln_EPS	Log transformed EPS	34,218	.781	2.793	-9.21	13.206

(Correlation matrix in Appendix 1)

This paper will investigate on listed firms from different countries by gathering various data using International Securities Identification Number (ISIN) to identify companies. Also, it is a panel data where data are extracted from 2013 to 2023. Since 2013 is the year where most companies have available ESG scores data which are the key indicators in this paper, it will therefore use 11 years data from 2013 to 2023.

Dependent variable

As a measure for a firm's performances, *labour productivity* is used which it captures a revenue generated per employee. It is calculated by $Revenue\ /\ Number\ of\ employees$ where both revenue

and number of employees are extracted from the database Compustat – Capital IQ from Wharton Research Data Services. Revenue is in billions and therefore, *labour productivity* is in the unit of billion per employee (bil/employee). Moreover, the distribution of the variable is positively skewed, it is transformed into the log format.

Explanatory variables

The main explanatory variable used in the paper is ESG scores. This paper will use 4 different types of scores which are *ESG combined*, *E pillar*, *S pillar*, and *G pillar* scores. *ESG combined* is the general ESG score of a firm and *E, S,* and *G pillar* scores are scores from specific criteria that constitutes ESG which are Environment, Social and Governance. By using 4 different types, not only the analysis could find the general impact of ESG scores on firms' performances, but also it could find out which specific pillar of ESG has the impact. ESG scores are extracted from Refinitiv database.

Also, to take diversity into account, *female ratio* and *nationality mix* are used. Both data are extracted from BoardEx database. *Female ratio* shows the proportion of female board member in a board and *nationality mix* shows the proportion of board member that are from different countries than the firm's base country. They are both ranging from 0 to 1 where 0 indicates having low proportion of female and foreigners in a board and 1 indicates all board members are female or foreigners.

Control variables

There are several control variables used to test hypotheses, which are *average time spent in the company, total assets, firm age, return on assets, R&D expenditures,* and *Earnings per Share*. *Average time spent in the company* measures average year of board members' duration spent in the company and it is extracted from BoardEx. *Total assets* are in billions indicating total assets by a firm, *firm age* is calculated by $Year - Year\ of\ incorporation$ indicating how many years have a firm been playing a role in the market, and *Return on Assets* is calculated as $net\ income\ /\ total\ assets$. Moreover, *R&D expenditure* is how much did a firm spend on research and development, and lastly, *Earnings per Share* is how much profit did a firm take from a share. All these data were extracted from Compustat – Capital IQ.

Also, similar to *labour productivity*, since all of these variables were skewed which needed some adjustment to be unbiased, log transformation were done to all of control variables and the log formats were taken into account when running the analysis.

Methodology

To test hypotheses, this paper will use two different methodologies: fixed effects and IV regression. As there are possibilities of endogeneity and reverse causality issues, this paper is taking two different methods into account to correctly measure the impact.

Since there are three different explanatory variables used to test the hypotheses, three instruments are used. As the instrumental variable of *ESG scores*, *Human Development Index (HDI)* from United Nations Development Programme (UNDP) is used. It is a country-level data where it measures how much does a country focus on their people and community as their criteria of development not just focusing on economic growth alone. Which means, it is might impact ESG scores, but not directly correlated with firms' performances which could work as the instrument. Also, as the instrumental variable of *female ratio*, historical values of female ratio is used. It is a firm-level data where the average female ratio is calculated from 1997 till 2 years before the year of data. To elaborate, if the data's year is 2013, then historical value of female ratio is the average of female ratio from 1997 till 2011 and if the data's year is 2020, then it is the average from 1997 till 2018. By giving 2 years difference between the data year and historical value, it could reduce the issue of collinearity with the explanatory variable and the instrumental variable whereas calculating the average until 1 year before or until the exact data year can be highly correlated. Lastly, the instrumental variable for *nationality mix* is also derived in the same way as the *female ratio* where the historical values of nationality mix is used.

To test the first hypothesis, solely *ESG scores* with control variables are used. Firstly, fixed effect model will be estimated and then, IV regression using *HDI* will be estimated. The equation used to test the first hypothesis is as follows:

$$Labour\ productivity = \beta_0 + \beta_1\ ESG\ Scores + \beta_2\ Controls + \varepsilon$$

where ESG Scores have four measures of ESG combined, E pillar, S pillar, and G pillar scores and Controls are control variables.

To test the second hypothesis, *female ratio* is added to see the impact of female board members. Also, to find the effect of female ratio when ESG scores are also considered, interaction term between the two is used. Lastly, testing for the third hypothesis takes the same methodology as the second hypothesis with female ratio changed into *nationality mix*. By doing so, it will capture the effects of *female ratio* and *nationality mix* alone and effects when it is considered together with ESG scores. It allows the paper to compare whether *female ratio* and *nationality mix* themselves play a crucial role to firms' performances or play a crucial role only when it is considered together with ESG scores. After estimating them with fixed effects, IV regression using historical values will be estimated. Therefore, equations used to test two hypotheses are as follows:

$$Labour\ productivity = \beta_0 + \beta_1\ ESG\ Scores + \beta_2\ Female\ Ratio + \beta_3\ ESG\ Scores * Female\ Ratio + \beta_4\ Controls + \varepsilon$$

$$Labour\ productivity = \beta_0 + \beta_1\ ESG\ Scores + \beta_2\ Nationality\ Mix + \beta_3\ ESG\ Scores * Nationality\ Mix + \beta_4\ Controls + \varepsilon$$

where ESG Scores have four measures of ESG combined, E pillar, S pillar, and G pillar scores and Controls are control variables.

Results

Table 2 –Testing for the effect of ESG scores

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	ln_labour_productivity – Fixed Effects				ln_labour_productivity – IV regression			
esg_combined	-8.80e-05				0.0695***			
	(0.000598)				(0.0203)			
e_pillar		0.000531				0.0314***		
		(0.000576)				(0.00555)		
s_pillar			0.000388				0.351	
			(0.000600)				(0.507)	
g_pillar				0.000263				0.0873**
				(0.000392)				(0.0372)
female_ratio	0.0529	0.0528	0.0529	0.0443	-0.494**	0.0483	-0.0911	-2.707**
	(0.0786)	(0.0775)	(0.0776)	(0.0765)	(0.235)	(0.0986)	(0.842)	(1.212)
nationality_mix	-0.00932	-0.00736	-0.00855	-0.0100	0.0203	0.106*	-0.616	-0.168
	(0.0479)	(0.0480)	(0.0479)	(0.0478)	(0.0962)	(0.0610)	(1.005)	(0.157)
firm_ln_total_assets	0.121***	0.118**	0.120***	0.121***	-0.139	-0.0517	-1.009	-0.0136
	(0.0461)	(0.0471)	(0.0463)	(0.0457)	(0.0948)	(0.0456)	(1.660)	(0.0995)
firm_ln_avg_time_company	0.0653	0.0643	0.0645	0.0640	-0.0762	-0.00950	-0.327	-0.342**
	(0.0404)	(0.0401)	(0.0401)	(0.0411)	(0.0486)	(0.0235)	(0.548)	(0.168)
firm_ln_age	-0.106	-0.112	-0.107	-0.106	-0.279**	-0.308***	-0.824	0.167
	(0.0752)	(0.0753)	(0.0751)	(0.0748)	(0.133)	(0.0836)	(1.282)	(0.177)
firm_ln_rnd	0.0515***	0.0505***	0.0508***	0.0512***	-0.0278	-0.00878	-0.328	-0.00463
	(0.0161)	(0.0159)	(0.0161)	(0.0161)	(0.0287)	(0.0152)	(0.541)	(0.0355)
firm_ln_EPS	0.0754***	0.0759***	0.0752***	0.0755***	0.0750***	0.0991***	-0.0986	0.0957***
	(0.0230)	(0.0230)	(0.0229)	(0.0230)	(0.0239)	(0.0153)	(0.271)	(0.0364)
firm_ln_ROA	-0.0118	-0.0123	-0.0118	-0.0119	-0.0252	-0.0298*	0.00588	-0.0461
	(0.0212)	(0.0212)	(0.0211)	(0.0212)	(0.0266)	(0.0162)	(0.131)	(0.0412)

Constant	-6.760***	-6.755***	-6.769***	-6.772***	-7.837***	-6.525***	-14.04	-10.18***
	(0.272)	(0.270)	(0.273)	(0.268)	(0.521)	(0.243)	(10.78)	(1.594)
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	7,913	7,913	7,913	7,913	6,385	6,385	6,385	6,385
R-squared	0.130	0.130	0.130	0.130				
Number of ISIN_final	1,658	1,658	1,658	1,658	1,367	1,367	1,367	1,367

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 3 –Testing for the effect of ESG scores when female ratio is included

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	ln_labour_productivity – Fixed Effects				ln_labour_productivity – IV regression			
esg_combined	0.000417				0.0529***			
	(0.000956)				(0.0173)			
inter_combined_female	-0.00268				0.0385*			
	(0.00324)				(0.0199)			
e_pillar		0.000430				0.0298***		
		(0.000782)				(0.00624)		
inter_e_female		0.000714				0.0275**		
		(0.00253)				(0.0107)		
s_pillar			0.000376				0.00645	
			(0.000915)				(0.00817)	
inter_s_female			7.79e-05				0.0174**	
			(0.00301)				(0.00757)	
g_pillar				-0.000150				0.0334***
				(0.000558)				(0.00994)

inter_g_female				0.00220				-0.00954
				(0.00273)				(0.0157)
female_ratio	0.208	0.0120	0.0480	-0.0811	-2.689**	-1.636**	-1.086**	-0.359
	(0.199)	(0.156)	(0.190)	(0.138)	(1.276)	(0.659)	(0.512)	(0.862)
nationality_mix	-0.00825	-0.00791	-0.00856	-0.0114	0.00658	0.109	-0.00751	-0.0350
	(0.0478)	(0.0480)	(0.0478)	(0.0470)	(0.0913)	(0.0671)	(0.0487)	(0.0670)
firm_ln_total_assets	0.121***	0.118**	0.120***	0.121***	-0.103	-0.0597	0.0824**	0.0712*
	(0.0462)	(0.0471)	(0.0462)	(0.0460)	(0.0853)	(0.0503)	(0.0355)	(0.0398)
firm_ln_avg_time_company	0.0665	0.0639	0.0644	0.0633	-0.0206	0.0143	0.0447**	-0.0651
	(0.0411)	(0.0410)	(0.0412)	(0.0410)	(0.0500)	(0.0313)	(0.0219)	(0.0460)
firm_ln_age	-0.110	-0.111	-0.107	-0.104	-0.127	-0.326***	0.0107	0.111
	(0.0752)	(0.0762)	(0.0750)	(0.0742)	(0.136)	(0.114)	(0.0645)	(0.100)
firm_ln_rnd	0.0511***	0.0506***	0.0508***	0.0514***	-0.00714	-0.00635	0.0325***	0.0246*
	(0.0160)	(0.0159)	(0.0160)	(0.0161)	(0.0244)	(0.0164)	(0.0121)	(0.0146)
firm_ln_EPS	0.0753***	0.0760***	0.0752***	0.0753***	0.0888***	0.120***	0.0856***	0.0963***
	(0.0229)	(0.0230)	(0.0229)	(0.0230)	(0.0233)	(0.0175)	(0.0124)	(0.0171)
firm_ln_ROA	-0.0117	-0.0124	-0.0118	-0.0117	-0.0393	-0.0488***	-0.0296**	-0.0378**
	(0.0211)	(0.0212)	(0.0211)	(0.0213)	(0.0256)	(0.0182)	(0.0125)	(0.0185)
Constant	-6.774***	-6.755***	-6.769***	-6.756***	-8.111***	-6.643***	-7.191***	-8.610***
	(0.276)	(0.270)	(0.275)	(0.276)	(0.614)	(0.341)	(0.360)	(0.587)
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	7,913	7,913	7,913	7,913	5,843	5,843	5,843	5,843
R-squared	0.130	0.130	0.130	0.130				
Number of ISIN_final	1,658	1,658	1,658	1,658	1,282	1,282	1,282	1,282

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 4 –Testing for the effect of ESG scores when nationality mix is included

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	ln_labour_productivity – Fixed Effects				ln_labour_productivity – IV regression			
esg_combined	-0.000985				0.0421***			
	(0.000845)				(0.0129)			
inter_combined_nationality	0.00304				-0.0359***			
	(0.00186)				(0.0123)			
e_pillar		-8.12e-05				0.0321***		
		(0.000515)				(0.00573)		
inter_e_ nationality		0.00273*				-0.0145		
		(0.00164)				(0.0134)		
s_pillar			-0.000479				-0.0497	
			(0.000625)				(0.0486)	
inter_s_ nationality			0.00347*				-0.0458***	
			(0.00186)				(0.0169)	
g_pillar				-0.000229				0.0434**
				(0.000499)				(0.0176)
inter_g_ nationality				0.00199*				-0.0524***
				(0.00120)				(0.0166)
female_ratio	0.0490	0.0464	0.0459	0.0404	-0.111	0.0511	0.133	-0.661
	(0.0783)	(0.0779)	(0.0773)	(0.0765)	(0.152)	(0.109)	(0.169)	(0.440)
nationality_mix	-0.184	-0.160	-0.219*	-0.128	2.177***	0.980	3.119***	3.127***
	(0.117)	(0.107)	(0.119)	(0.0883)	(0.741)	(0.786)	(1.166)	(0.988)
firm_ln_total_assets	0.119**	0.116**	0.116**	0.118**	0.0449	-0.0261	0.357**	0.146***
	(0.0464)	(0.0472)	(0.0470)	(0.0460)	(0.0642)	(0.0558)	(0.170)	(0.0462)
firm_ln_avg_time_company	0.0643	0.0631	0.0627	0.0638	0.0509	0.0413	0.0912*	-0.0600
	(0.0400)	(0.0395)	(0.0393)	(0.0411)	(0.0333)	(0.0295)	(0.0474)	(0.0688)
firm_ln_age	-0.102	-0.106	-0.104	-0.104	-0.137	-0.364***	-0.0320	0.0542
	(0.0752)	(0.0754)	(0.0750)	(0.0751)	(0.0951)	(0.107)	(0.138)	(0.117)
firm_ln_rnd	0.0519***	0.0501***	0.0510***	0.0515***	0.00625	-0.00255	0.0920*	0.0151

	(0.0162)	(0.0159)	(0.0161)	(0.0162)	(0.0174)	(0.0165)	(0.0505)	(0.0177)
firm_ln_EPS	0.0752***	0.0752***	0.0752***	0.0756***	0.0888***	0.114***	0.131***	0.0908***
	(0.0229)	(0.0230)	(0.0229)	(0.0229)	(0.0163)	(0.0158)	(0.0426)	(0.0185)
firm_ln_ROA	-0.0117	-0.0117	-0.0115	-0.0121	-0.0315*	-0.0445***	-0.0451	-0.0244
	(0.0212)	(0.0212)	(0.0211)	(0.0211)	(0.0176)	(0.0168)	(0.0304)	(0.0203)
Constant	-6.726***	-6.734***	-6.726***	-6.750***	-8.257***	-6.853***	-5.778***	-9.049***
	(0.269)	(0.266)	(0.270)	(0.267)	(0.449)	(0.364)	(1.619)	(0.933)
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	7,913	7,913	7,913	7,913	5,770	5,770	5,770	5,770
R-squared	0.131	0.131	0.132	0.130				
Number of ISIN_final	1,658	1,658	1,658	1,658	1,260	1,260	1,260	1,260

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Since this thesis has conducted two different regressions, fixed effects and IV regression, the result tables also contain results from two models. Column (1) to (4) are the results from fixed effects model and column (5) to (8) are from IV regression. To elaborate, column (1) and (5) shows the effects of ESG combined score on labour productivity, column (2) and (6) shows the effects of E pillar specifically, column (3) and (7) shows the effects of S pillar, and lastly, column (4) and (8) show the effects of G pillar.

Fixed Effects

To first analyse the fixed effects model, Table 2 shows the effects of ESG scores on labour productivity, and ESG combined has negative coefficient whereas each of the E, S, and G pillar has positive coefficients. However, the results are not statistically significant so it is hard to accept the first hypothesis that ESG scores will increase firm performances. Also, although the effects are not statistically significant, female ratio has all positive coefficients and nationality mix has all negative coefficients. Moreover, among the control variables, firm's total assets has positive and significant effects towards firm performances for all 4 ESG scores, and this tendency also applies to R&D expenditure and Earnings Per Share by a firm However, it is interesting to see that higher firm age leads to lowering labour productivity for ESG combined and E pillar.

Table 3 shows the results of the effects of ESG scores on labour productivity when a board's female ratio is included, and it is captured through the interaction term between ESG scores and female ratio. In Table 3, it is shown that the interaction term between ESG combined and female ratio and G pillar score itself has negative coefficients whereas all other ESG scores and interaction terms have positive coefficients. However, similar to Table 2, the effects are not statistically significant so it is hard to accept the second hypothesis that the impact of ESG scores on firm performances will be more positive when there is higher proportion of female members in a board. Also, although the effects are not statistically significant, female ratio yields positive coefficients in column (1), (2), and (3) and negative coefficient in column (4), and nationality mix yields negative coefficients for all fixed effects model. Moreover, effects captured among the control variables remain the same that firm's total assets, R&D expenditures and Earnings Per Share have positive and significant effects towards firm performances.

Lastly, Table 4 shows the results of the effects of ESG scores on labour productivity when a board's nationality mix is included, and it is captured through the interaction term between ESG scores and nationality mix. In this table, it is important to look at column (2), (3) and (4) where it has significant effects from interaction terms. In column (2), although coefficient for E pillar is statistically insignificant, it shows negative coefficient. However, when it is interacted with nationality mix, then it turns out to be positive and significant which can be referred as nationality mix does play a crucial role to firm's performances when it is considered with E pillar score by turning the effect from negative to

positive. To further extend, column (3) and (4) shows the similar effect. In column (3), S pillar shows negative coefficient though it is insignificant and yields positive and significant value when it is interacted with nationality mix, and in column (4), G pillar also shows negative coefficient with statistically insignificant level, but it yields positive and significant value when it is interacted with nationality mix. Though the significance level is at 10% which is not quite strong, it still gives some insight that nationality mix plays a crucial role of yielding positive effects towards firm performances when E, S and G pillars are considered separately. However, since E, S and G pillar's cofficients are not significant, it is hard to find out whether adding nationality mix actually improves further on firm performances.

IV Regression

The reason for fixed effects model not having many significant values can be due to the endogeneity issues. To address it, this thesis has re-run the estimation using IV regression with *HDI*, *historical female ratio*, and *historical nationality mix* as instrument variables. In Table 2, after ESG scores have been controlled using the instrumental variable of *HDI*, there are some significant effects of ESG scores on labour productivity. To elaborate, column (5) shows scoring one more point in ESG combined score increases labour productivity by 7.2%[1] and column (6) shows scoring one more point in E pillar score increases labour productivity by 3.19% with the significance level of 1% for both scores. Also, column (8) shows that G pillar score increase labour productivity by 9.12% with the significance level of 5%. However, although S pillar has the largest coefficient of 0.351, it shows that it is not statistically significant. Moreover, it is interesting to see the control variables that for ESG combined and E pillar scores, a firm's age will negatively affect towards labour productivity but EPS will positively affect labour productivity for ESG combined, E and G pillar scores. Therefore, from the analysis, it is clear that ESG combined, E pillar, and G pillar scores increases labour productivity whereas S pillar shows no relevance, and among those scores, G pillar score shows the greatest impact towards firm performances.

In Table 3's column (5) to (8), it shows the effects of ESG scores on labour productivity when female ratio within a board is implemented, and similar to Table 2, controlling for ESG scores and female ratio yielded higher significance level of results. Column (5) shows that scoring one more point in ESG combined score increases labour productivity by 5.43% with the significance level of 1% and scoring one more point in ESG combined score along with one more point in female ratio increases labour productivity by 3.92% with the significance level of 10%. It is important to see that the female ratio itself has negative and significant effect towards labour productivity which means that female ratio yields positive effects to labour productivity only if it is considered with ESG combined score. Moreover, column (6) shows that E pillar score increases labour productivity by 3.03% and when E

[1] Percentages are calculated with the following expression : $100 * (e^{coefficient\ value} - 1)$

pillar score is considered along with female ratio, it increases by 2.79% with the significance level of 1%. Also for E pillar score, it is clear that having higher proportion of female in a borad and higher E pillar score does not increase firm performances more than E pillar score itself, but when considering female ratio, it has initially negative and significant value which is referred as it acts as a positive factor only when it is considered together with E pillar score. Thus, for ESG combined and E pillar score, the results are still aligned with the first hypothesis that ESG scores will increase firm performances, but it rejects hypothesis 2 that the effect will be larger when female ratio is included. Column (7) shows the effect of S pillar, and the interaction term has positive and significant value that it increases labour productivity by 1.75% whereas S pillar itself yields insignificant value. Also, the effect of female ratio is the same as ESG combined and E pillar scores. Thus, hypothesis 2 is confirmed here as the interaction term yields more positive value than S pillar itself. Lastly, column (8) shows the effect of G pillar score and unlike S pillar, G pillar takes negative but insignificant value for the interaction term and it increases labour productivity by 3.39% when it is considered solely. Therefore, it is clear that hypothesis 2 is confirmed only for S pillar scores and it is rejected for ESG combined, E pillar and G pillar scores meaning that it is S pillar that takes crucial role in firm performances when it is considered together with female ratio of a board.

Table 4 shows the effect of ESG scores on labour productivity when nationality mix of a board is considered. Column (5) shows that ESG combined score has positive and significant effect towards labour productivity, but once it is considered with nationality mix, it decreases labour productivity by 3.53% which is significant in 1%. Meaning, when ESG combined score is considered solely, it has positive impact towards labour productivity, but when nationality mix is included, then it decreases firm performances. It is also important to note that nationality mix itself takes positive and significant value. Which means, although both ESG combined score and nationality mix respectively takes positive and significant values towards labour productivity, once it is considered together, then it decreases labour productivity. There is another trend captured for E pillar score where score itself takes positive and significant value but it becomes insignificant when nationality mix is included. In column (7), the effect of S pillar score is negative and insignificant with the magnitude of 4.85%, but once it is considered with nationality mix, it becomes significant at 1% level by decreasing labour productivity by 4.48%. The magnitude became smaller meaning that nationality mix mitigates decreasing effect which can be seen as confirming the hypothesis 3 that the effect of ESG scores on labour productivity will be larger when nationality mix is considered though the effect itself is negative. Lastly, column (8) shows that G pillar score increases labour productivity by 4.44% but when nationality mix is included, it decreases the labour productivity by 5.11% with the significance level of %% and 1% respectively. This is the same trend as ESG combined score. Therefore, it is clear that it is only S pillar score that takes important role towards firm performances when nationality mix is included and confirms hypothesis 3.

Diagnostics tests for instrumental variables

It is interesting to compare coefficients and significance levels between fixed effects and IV regression that they increase quite a lot when instrument variables are introduced. However, to check whether the results from IV regressions are reliable or not, this thesis has run several diagnostics test to check for instrument variables.

The first test for instrument variables is F-test results of the first stage regressions[2]. For all first stages, F-test results exceed 10 which is considered as instruments are strong that it can provide sufficient estimation to the variable of interest. Especially for female ratio and nationality mix, it has the values over 30,000 and 40,000 respectively which are really strong. On top of checking F-statistics values, this thesis has conducted 4 more diagnostics tests[3] of Anderson Canonical Correlation LM Statistic, Anderson-Rubin Wald test, Stock-Wright LM S Statistic and Sargan test. Anderson Canonical Correlation LM values tests for underidentification of the model, Anderson-Rubin Wald test tests for joint significance of endogenous variables, Stock-Wright LM S Statistics tests for validity of instruments and Sargan test tests for overidentification test of all instruments.

Although diagnostics results are quite fuzzy, these are the overall conclusion. The diagnostics results for Table 2's column (5) yield that the instrument used is strong and valid, and endogenous variables are jointly significant when explaining the dependent variable. Meaning, the model is well-identified that the results of IV regression is reliable without biased information. The results for Table 2's column (6) remains the same as column (5) whereas column (7) shows 1 valid and 1 invalid result. However, since F-test results are strong and the joint significance test also yields positive output that the model is well-identified, this thesis will assume as valid and strong model. Also, column (8) results show that the instrument is valid and strong, and the model is well-identified. Table 3's column (5), (6), (7) and (8) also show the same output as Table 2 and it remains the same for Table 4. As mentioned briefly, not all 4 diagnostics tests yielded the same results of valid and strong except for the joint significance test. However, when considering together with F-statistics results, the above's overall conclusion is made. Therefore, the IV regressions results are reliable with strong and valid instrument with well-identified model.

[2] Appendix 2 Table 9 – F-test results
[3] Appendix 2 Table 10 – Diagnostics tests results

Robustness check

To test whether the findings above are consistent, this thesis has run robustness check with different variable that measures firm performances which is Return on Assets (ROA).

Table 5 shows the effect of ESG scores on firm's ROA where it takes the same trend as labour productivity that ESG combined, E pillar, and G pillar scores have positive and significant values whereas S pillar takes positive but insignificant value. Meaning, ESG combined, E pillar, and G pillar scores increases firm performances. Table 6 shows the effect of ESG scores on firm's ROA when female ratio is included, the result is consistent with the main regression result that only S pillar increases firm performances when female ratio is included and ESG combined, E pillar and G pillar does not improve ROA. However, the robustness check result for the third hypothesis (Table 7) is not in line with the main result where it all shows the interaction terms decrease the effects of ESG scores itself whereas the main result supports that S pillar increases labour productivity further when it is considered along with nationality mix.

Robustness Check Results

Table 5 –Robustness check for the effect of ESG scores

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	firm_ln_ROA – Fixed Effects				firm_ln_ROA – IV regression			
esg_combined	-0.000202				0.0705***			
	(0.000594)				(0.0254)			
e_pillar		0.000471				0.0272***		
		(0.000669)				(0.00612)		
s_pillar			-0.000503				0.367	
			(0.000572)				(0.639)	
g_pillar				-8.65e-05				0.0845**
				(0.000471)				(0.0416)
female_ratio	0.129	0.128	0.127	0.130	-0.512*	0.0572	-0.629	-2.562*
	(0.107)	(0.107)	(0.107)	(0.108)	(0.271)	(0.104)	(1.478)	(1.319)
nationality_mix	0.0931*	0.0945*	0.0929*	0.0934*	0.0560	0.136**	-0.867	-0.0406
	(0.0555)	(0.0556)	(0.0554)	(0.0554)	(0.0967)	(0.0625)	(1.687)	(0.142)
firm_ln_total_assets	-0.597***	-0.600***	-0.596***	-0.598***	-0.802***	-0.696***	-1.885	-0.638***
	(0.0468)	(0.0473)	(0.0467)	(0.0465)	(0.103)	(0.0452)	(2.327)	(0.0820)
firm_ln_avg_time_company	0.0134	0.0121	0.0138	0.0133	-0.0892	-0.0112	-0.342	-0.343*
	(0.0250)	(0.0252)	(0.0253)	(0.0251)	(0.0583)	(0.0260)	(0.679)	(0.192)
firm_ln_age	0.00906	0.00380	0.00938	0.00798	-0.211*	-0.213***	-0.672	0.219
	(0.0520)	(0.0513)	(0.0517)	(0.0514)	(0.123)	(0.0770)	(1.204)	(0.198)
firm_ln_rnd	-0.0184	-0.0193	-0.0180	-0.0186	-0.0762***	-0.0566***	-0.263	-0.0656*
	(0.0144)	(0.0142)	(0.0143)	(0.0144)	(0.0274)	(0.0146)	(0.425)	(0.0342)
firm_ln_EPS	0.780***	0.780***	0.780***	0.780***	0.752***	0.773***	0.579*	0.759***
	(0.0191)	(0.0191)	(0.0191)	(0.0191)	(0.0143)	(0.00867)	(0.330)	(0.0188)
Constant	-3.189***	-3.187***	-3.183***	-3.188***	-4.792***	-3.393***	-12.10	-6.888***

	(0.175)	(0.173)	(0.176)	(0.173)	(0.672)	(0.238)	(15.53)	(1.862)
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	9,039	9,039	9,039	9,039	6,793	6,793	6,793	6,793
R-squared	0.724	0.724	0.724	0.724				
Number of ISIN_final	1,848	1,848	1,848	1,848	1,429	1,429	1,429	1,429

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 6 –Robustness check for the effect of ESG scores when female ratio is included

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	firm_ln_ROA – Fixed Effects				firm_ln_ROA – IV regression			
esg_combined	-0.000761				0.0259**			
	(0.000864)				(0.0119)			
inter_combined_female	0.00316				0.00721			
	(0.00327)				(0.0126)			
e_pillar		-7.33e-05				0.0255***		
		(0.000776)				(0.00692)		
inter_e_female		0.00400				0.00817		
		(0.00272)				(0.00996)		
s_pillar			-0.00115*				-0.00213	
			(0.000700)				(0.00779)	
inter_s_female			0.00468*				0.00136	
			(0.00273)				(0.00842)	
g_pillar				4.11e-05				0.0160**
				(0.000735)				(0.00810)
inter_g_female				-0.000719				-0.0137
				(0.00275)				(0.0141)
female_ratio	-0.0520	-0.0947	-0.167	0.171	-0.636	-0.494	-0.0944	0.356

	(0.209)	(0.170)	(0.179)	(0.186)	(0.780)	(0.585)	(0.556)	(0.753)
nationality_mix	0.0922*	0.0932*	0.0923*	0.0938*	0.0236	0.0995	0.0460	0.0276
	(0.0555)	(0.0555)	(0.0554)	(0.0553)	(0.0617)	(0.0641)	(0.0565)	(0.0551)
firm_ln_total_assets	-0.597***	-0.599***	-0.596***	-0.598***	-0.659***	-0.700***	-0.563***	-0.581***
	(0.0468)	(0.0473)	(0.0467)	(0.0465)	(0.0532)	(0.0489)	(0.0385)	(0.0307)
firm_ln_avg_time_company	0.0120	0.00992	0.0110	0.0135	-0.0197	-0.0246	0.0151	-0.0360
	(0.0248)	(0.0251)	(0.0250)	(0.0250)	(0.0349)	(0.0321)	(0.0254)	(0.0381)
firm_ln_age	0.0131	0.0133	0.0175	0.00745	-0.0458	-0.220**	-0.00613	0.0451
	(0.0517)	(0.0509)	(0.0514)	(0.0515)	(0.0903)	(0.108)	(0.0739)	(0.0856)
firm_ln_rnd	-0.0179	-0.0185	-0.0173	-0.0186	-0.0423***	-0.0543***	-0.0251**	-0.0322***
	(0.0142)	(0.0142)	(0.0142)	(0.0144)	(0.0149)	(0.0152)	(0.0116)	(0.0120)
firm_ln_EPS	0.780***	0.780***	0.780***	0.780***	0.771***	0.785***	0.778***	0.778***
	(0.0191)	(0.0191)	(0.0191)	(0.0191)	(0.00905)	(0.00902)	(0.00826)	(0.00778)
Constant	-3.174***	-3.192***	-3.172***	-3.193***	-4.019***	-3.272***	-3.272***	-4.137***
	(0.178)	(0.173)	(0.177)	(0.175)	(0.442)	(0.318)	(0.370)	(0.485)
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	9,039	9,039	9,039	9,039	6,221	6,221	6,221	6,221
R-squared	0.724	0.725	0.725	0.724				
Number of ISIN_final	1,848	1,848	1,848	1,848	1,342	1,342	1,342	1,342

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 7 –Robustness check for the effect of ESG scores when nationality mix is included

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	firm_ln_ROA – Fixed Effects				firm_ln_ROA – IV regression			
esg_combined	-4.09e-05				0.0643***			
	(0.000732)				(0.0242)			
inter_combined_nationality	-0.000577				-0.0172			
	(0.00166)				(0.0178)			
e_pillar		0.000880				0.0266***		
		(0.000735)				(0.00715)		
inter_e_ nationality		-0.00190				-0.00530		
		(0.00144)				(0.0137)		
s_pillar			-0.000306				0.0273	
			(0.000678)				(0.0239)	
inter_s_ nationality			-0.000827				-0.0224**	
			(0.00152)				(0.0106)	
g_pillar				-0.000402				0.0758**
				(0.000567)				(0.0323)
inter_g_ nationality				0.00131				-0.0688***
				(0.00158)				(0.0262)
female_ratio	0.129	0.130	0.128	0.128	-0.437*	-0.0342	-0.00736	-1.550*
	(0.107)	(0.107)	(0.107)	(0.108)	(0.256)	(0.109)	(0.110)	(0.804)
nationality_mix	0.126	0.198**	0.143	0.0163	1.023	0.404	1.390*	4.093***
	(0.105)	(0.0909)	(0.0975)	(0.109)	(1.049)	(0.766)	(0.722)	(1.553)
firm_ln_total_assets	-0.597***	-0.600***	-0.595***	-0.599***	-0.756***	-0.699***	-0.621***	-0.555***
	(0.0467)	(0.0472)	(0.0467)	(0.0464)	(0.106)	(0.0576)	(0.0992)	(0.0638)
firm_ln_avg_time_company	0.0135	0.0129	0.0142	0.0131	-0.0422	-0.0137	0.0265	-0.227*
	(0.0250)	(0.0251)	(0.0252)	(0.0250)	(0.0557)	(0.0327)	(0.0298)	(0.128)
firm_ln_age	0.00799	-0.00142	0.00784	0.00963	-0.140	-0.252**	-0.0360	0.199
	(0.0514)	(0.0506)	(0.0514)	(0.0510)	(0.135)	(0.108)	(0.0854)	(0.203)
firm_ln_rnd	-0.0185	-0.0192	-0.0181	-0.0183	-0.0675***	-0.0557***	-0.0424**	-0.0655**

	(0.0143)	(0.0142)	(0.0143)	(0.0144)	(0.0244)	(0.0161)	(0.0181)	(0.0278)
firm_ln_EPS	0.780***	0.780***	0.780***	0.780***	0.770***	0.790***	0.771***	0.788***
	(0.0191)	(0.0191)	(0.0191)	(0.0191)	(0.0144)	(0.00890)	(0.0161)	(0.0156)
Constant	-3.193***	-3.193***	-3.189***	-3.176***	-5.080***	-3.240***	-4.331***	-7.027***
	(0.178)	(0.174)	(0.178)	(0.176)	(0.777)	(0.328)	(0.829)	(1.723)
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	9,039	9,039	9,039	9,039	6,136	6,136	6,136	6,136
R-squared	0.724	0.724	0.724	0.724				
Number of ISIN_final	1,848	1,848	1,848	1,848	1,317	1,317	1,317	1,317

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Discussion

In summary, this thesis has found a clear relationship that ESG scores increases firm performances, and when female ratio and nationality mix of a board is considered, then it is S pillar specifically that takes important role in increasing firm performances. Moreover, the effects of control variables are quite varying, but in general, when ESG scores and interaction terms take significant values, then firm's age decreases labour productivity whereas total assets and EPS increases labour productivity. This is to some extent related to the findings from literature reviews that ESG scores increases firm performances and having diverse board composition in terms of gender and nationality representing how diverse is a company leads to higher firm performances. However, referring back to the results of Table 4 where it was not in line with the hypothesis which it showed that including nationality mix decreases labour productivity for ESG combined, E and G pillar scores, findings from previous scholars are rejected. Thus, in terms of interpreting the results of nationality mix of a board, the effects can vary, but with regards to hypothesis 3, it is confirmed with S pillar score.

Although this thesis has managed to find some insightful relationship between ESG scores and firm performances, there are some limitations that can negatively affect credibility of results.

Firstly, although this thesis has controlled for endogeneity issue using instrumental variables, there are still potential endogeneity issues due to complexity in variables that hypotheses want to test on. To elaborate, although robustness check for hypothesis 1 and 2 show that the results are consistent with the main result, but robustness check for hypothesis 3 yielded different results that when S and G pillar scores are interacted with nationality mix, then it decreases further with labour productivity. Since having inconsistent robustness check can be inferred as mis-specification of model, potential endogeneity issues arise once more. One of the reasons can be omitted variables. As relationship that this thesis trying to find is hard to untangle specific cause and effect, there could be omitted variables that are captured in the error term leading to inconsistencies and endogeneity. For example, this thesis currently takes firm-specific control variables only, but there also could be country and industry level variables that needs to be controlled for and have influence on firm performances. Moreover, there is reverse causality issue that might cause potential endogeneity issue. When trying to find the relationship between ESG scores and firm performances, not only ESG scores increase firm performances but it can also be firms with higher performances have more potential to spend times on sustainability which leads to higher ESG scores.

Adding on, having only 2 years of gap when calculating for the historical values of female ratio and nationality mix to use it as instrumental variables might be a short term in between where it might have high correlation with control variables and lead to potential endogeneity issue that instrumental variables could not fully resolve. However, due to limited data for ESG scores where not many companies had the availability to report for ESG back in 20th century and the early 2000s in the current

dataset, having larger gap in between led to too low number of observations and companies which would also lead to biased results and cause problem in generalizability of findings.

Moreover, not having all significant results for diagnostics tests for instrumental variables could also negatively affect credibility of results. For models that included diversity factors, among 4 diagnostics test that this thesis has used, at least one of them yielded insignificant results where it infers potential bias or mis-specification of model. Especially when it comes to the validity of instrumental variables, if one result gives valid but the other gives invalid sign, then it is hard to distinguish if the instrument is actually valid or not. This may be the result of potential endogeneity derived from instrumental variables, potential omitted variables and reverse causality issues.

Considering all, advice for future research would be to have broader and more depth in ESG dataset and include more control variables not only from firm level, but also country and industry levels. As the European Commission legislated that it is mandatory for firms to report on their sustainability through Corporate Sustainability Reporting Directive (CSRD) (European Commission, n.d.), there will be more data available in coming few years, and since data will be widely disclosed from most of the firms in the Europe, it will become more clear and accessible to gather ESG scores of firms. Then, research on similar topic using the larger sample size of firms acting in the Europe will be able to yield more credible results by generating instrumental variables with more gap in between but with more observations available. Also, including country and industry level control variables which was not included in this thesis would improve model specification leading to higher validity of the results. Although there are still some limitations in the thesis, it brings new insights academically where it finds the relationship between ESG scores and firm performances taking board members' diversity into account.

Conclusion

To conclude, this thesis analysed whether having higher ESG scores lead to higher firm performances where firm performances is measured by labour productivity including board members' diversity. It used 4 different types of ESG scores which are *ESG combined, E, S,* and *G pillar scores* and *female ratio* and *nationality mix* for the measure of diversity. It used panel data analysing with two different models, fixed effects and IV regression, where H*uman Development Index, historical value of female ratio* and *nationality mix* are used as instrumental variables.

It managed to find significant relationship with ESG scores and firm performances using IV regression that *ESG combined, E* and *G pillar scores* take significant effect, and when board members' diversity factor is included, then it is *S pillar score* taking significant effect towards firm performances. Thus, hypothesis 1 is supported by *ESG combined, E* and *G pillar scores* and hypothesis 2 and 3 is only supported by *S pillar score*.

This thesis also tested whether instruments used are strong and valid to check whether the results of IV regressions are reliable. Through F-statistics and four diagnostics tests, it managed to find that instruments are strong and valid leading to validation of the results found. However, there are still some limitations of the model used in the thesis causing endogeneity issue even though it was controlled through IV regression. Having these limitations leaves the room for future research where it could be improved and build stronger model including more control variables, larger sample size for ESG data, and generating historical values used in IV regression uncorrelated with control variables.

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Appendix 1 – Correlation matrix

Table 8 – Correlation matrix

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) ln_labour_productivity	1.000								
(2) esg_combined	-0.034	1.000							
(3) e_pillar	0.033	0.811	1.000						
(4) s_pillar	-0.122	0.862	0.714	1.000					
(5) g_pillar	-0.010	0.665	0.392	0.419	1.000				
(6) HDI	-0.375	0.023	0.050	0.023	0.000	1.000			
(7) hist_female	-0.146	0.116	0.037	0.128	0.114	0.128	1.000		
(8) hist_nationality	-0.177	0.176	0.130	0.192	0.204	0.148	0.047	1.000	
(9) female_ratio	-0.285	0.222	0.126	0.248	0.202	0.199	0.669	0.100	1.000
(10) nationality_mix	-0.209	0.201	0.154	0.215	0.215	0.200	0.040	0.779	0.120
(11) firm_ln_total_assets	0.231	0.437	0.546	0.411	0.297	0.005	-0.026	0.126	0.030
(12) firm_ln_avg_time_company	0.173	0.085	0.148	0.056	0.011	0.003	-0.186	-0.096	-0.147
(13) firm_ln_age	0.080	0.212	0.271	0.220	0.072	0.040	-0.046	-0.064	0.046
(14) firm_ln_rnd	0.638	0.279	0.387	0.182	0.188	-0.072	-0.220	-0.060	-0.267
(15) firm_ln_EPS	0.655	0.128	0.192	0.078	0.038	-0.192	-0.129	-0.093	-0.192
(16) firm_ln_ROA	-0.053	-0.080	-0.146	-0.063	-0.064	-0.058	0.012	0.004	0.021

Variables	(10)	(11)	(12)	(13)	(14)	(15)	(16)
(1) ln_labour_productivity							
(2) esg_combined							
(3) e_pillar							
(4) s_pillar							
(5) g_pillar							
(6) HDI							
(7) hist_female							
(8) hist_nationality							
(9) female_ratio							
(10) nationality_mix	1.000						
(11) firm_ln_total_assets	0.152	1.000					
(12) firm_ln_avg_time_company	-0.084	0.138	1.000				
(13) firm_ln_age	-0.012	0.212	0.443	1.000			
(14) firm_ln_rnd	-0.039	0.598	0.304	0.204	1.000		
(15) firm_ln_EPS	-0.098	0.305	0.254	0.284	0.683	1.000	
(16) firm_ln_ROA	-0.010	-0.438	0.040	-0.051	-0.082	0.146	1.000

Appendix 2 – Diagnostics Tests for Instrumental Variables

Table 9 - F-test results in first regressions

Table 2		
Column (5) ~ (8)	*ESG combined*	F(18, 5000) = 110.96
	E pillar	F(18, 5000) = 140.34
	S pillar	F(18, 5000) = 160.09
	G pillar	F(18, 5000) = 53.11
Table 3		
Column (5)	*ESG combined*	F(20, 4541) = 79.60
	Female_ratio	F(20, 4541) = 34499.85
	Inter_combined_female	F(20, 4541) = 994.87
Column (6)	*E pillar*	F(20, 4541) = 105.73
	Female_ratio	F(20, 4541) = 34499.85
	Inter_e_female	F(20, 4541) = 990.09
Column (7)	*S pillar*	F(20, 4541) = 121.74
	Female_ratio	F(20, 4541) = 34499.85
	Inter_s_female	F(20, 4541) = 1274.17
Column (8)	*G pillar*	F(20, 4541) = 44.72
	Female_ratio	F(20, 4541) = 34499.85
	Inter_g_female	F(20, 4541) = 688.44
Table 4		
Column (5)	*ESG combined*	F(20, 4490) = 78.15
	Nationality_mix	F(20, 4490) = 45681.59
	Inter_combined_nationality	F(20, 4490) = 599.82
Column (6)	*E pillar*	F(20, 4490) = 105.32
	Female_ratio	F(20, 4490) = 45681.59
	Inter_e_ nationality	F(20, 4490) = 536.65
Column (7)	*S pillar*	F(20, 4490) = 118.43
	Nationality_mix	F(20, 4490) = 45681.59
	Inter_s_ nationality	F(20, 4490) = 671.51
Column (8)	*G pillar*	F(20, 4490) = 43.67
	Nationality_mix	F(20, 4490) = 45681.59
	Inter_g_ nationality	F(20, 4490) = 505.24

Table 10 – Diagnostics tests for instrument variables

	Table 2	**Table 3**	**Table 4**
		Column (5) – ESG combined	
Anderson canon. Corr. LM statistics (Underidentification test)	Chi-sq(1) = 14.40 p-value = 0.0001	Chi-sq(2) = 13.66 p-value = 0.0011	Chi-sq(2) = 12.24 p-value = 0.0022
Anderson-Rubin Wald test (Weak-instrument-robust inference)	F(1,5000) = 69.92 p-value = 0.0000	F(4,4541) = 16.44 p-value = 0.000	F(4,4490) = 19.24 p-value = 0.0000
Stock-Wright LM S statistics (Weak-instrument-robust inference)	Chi-sq(1) = 69.21 p-value = 0.0000	Chi-sq(4) = 65.12 p-value = 0.0000	Chi-sq(4) = 75.99 p-value = 0.0000
Sargan statistics (Overidentification test of all instruments)	0.000 (equation exactly identified)	Chi-sq(2) = 3.265 p-value = 0.0708	Chi-sq(2) = 14.304 p-value = 0.0002
		Column (6) – E pillar	
Anderson canon. Corr. LM statistics (Underidentification test)	Chi-sq(1) = 59.20 p-value = 0.0000	Chi-sq(2) = 47.94	Chi-sq(2) = 15.11 p-value = 0.0005
Anderson-Rubin Wald test (Weak-instrument-robust inference)	F(1,5000) = 69.92 p-value = 0.000	F(4,4541) = 16.44 p-value = 0.0000	F(4,4490) = 19.24 p-value = 0.0000
Stock-Wright LM S statistics (Weak-instrument-robust inference)	Chi-sq(1) = 69.21 p-value = 0.0000	Chi-sq(4) = 65.12 p-value = 0.0000	Chi-sq(4) = 75.99 p-value = 0.0000
Sargan statistics (Overidentification test of all instruments)	0.000 (equation exactly identified)	Chi-sq(1) = 0.238 p-value = 0.6255	Chi-sq(1) = 1.057 p-value = 0.3038
		Column (7) – S pillar	
Anderson canon. Corr. LM statistics (Underidentification test)	Chi-sq(1) = 0.49 p-value = 0.4856	Chi-sq(2) = 14.77 p-value = 0.0006	Chi-sq(2) = 1.21 p-value = 0.5463
Anderson-Rubin Wald test	F(1,5000) = 69.92 p-value = 0.0000	F(4,4541) = 16.44 p-value = 0.000	F(4,4490) = 19.24 p-value = 0.0000

(Weak-instrument-robust inference)			
Stock-Wright LM S statistics (Weak-instrument-robust inference)	Chi-sq(1) = 69.21 p-value = 0.0000	Chi-sq(4) = 65.12 p-value = 0.0000	Chi-sq(4) = 75.99 p-value = 0.0000
Sargan statistics (Overidentification test of all instruments)	0.000 (equation exactly identified)	Chi-sq(1) = 52.345 p-value = 0.000	Chi-sq(1) = 0.213 p-value = 0.6444

Column (8) – G pillar

Anderson canon. Corr. LM statistics (Underidentification test)	Chi-sq(1) = 5.97 p-value = 0.0146	Chi-sq(2) = 22.37 p-value = 0.0000	Chi-sq(2) = 7.97 p-value = 0.019
Anderson-Rubin Wald test (Weak-instrument-robust inference)	F(1, 5000) = 69.92 p-value = 0.0000	F(4,4541) = 16.44 p-value = 0.0000	F(4,4490) = 19.24 p-value = 0.0000
Stock-Wright LM S statistics (Weak-instrument-robust inference)	Chi-sq(1) = 69.21 p-value = 0.0000	Chi-sq(4) = 65.12 p-value = 0.0000	Chi-sq(4) = 75.99 p-value = 0.0000
Sargan statistics (Overidentification test of all instruments)	0.000 (equation exactly identified)	Chi-sq(1) = 13.456 p-value = 0.0002	Chi-sq(1) = 17.772 p-value = 0.0000