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BEYOND SUSTAINABILITY: EMPIRICAL EVIDENCE FROM OECD COUNTRIES ON THE CONNECTION AMONG NATURAL RESOURCES, ESG PERFORMANCES, AND ECONOMIC DEVELOPMENT

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ABSTRACT. Many have seen a remarkable increase in environmental, social, and governance (ESG) practices in the context of natural resource management. ESG is practically known to help achieve the Sustainable Development Goals (SDG) with more responsible management of natural resources. Yet, limited economic literature exists to illuminate how natural resource management can affect the quality of economic development. This paper attempts to develop and test a theoretical model to understand the interlinkage between natural resource rent, ESG performance, and the quality of economic development at the country level. This study employs a data set of OECD countries during the period of 2000-2017. The path analysis model is used to define the relationship between the measured variables. Our empirical study shows a negative association between ESG performance and natural resource rent; in other words, better human development inhibits corruption and promotes improved ESG performance. This study observes the presence of bidirectional Granger causality between natural resource rent and ESG performance. It is suggested that ESG performance is more likely to be affected by the quality of institutions, rather than by the economy size. Good institutions enable the economy to reach optimum resource allocation.

JEL Classification: N50, O47, Q32

Keywords: natural resource rent, ESG, economic growth, HDI, path analysis model, Granger causality.

Introduction

The relationship between natural resources and economic development has become an everlasting riddle for scientific communities, especially within a sustainable economy. Many recognize that wealth from natural resources can promote increased state income, better developed financial institutions, or improved human capital. However, economic rents from natural resources can also lead to the corruption that eventually deteriorates economic growth and widens income inequality. Natural resource wealth is typical of many countries with bad

economic performance, especially those with non-democratic systems and poor-quality institutions (Bhattacharyya & Hodler, 2010; Daniele, 2011; van der Ploeg, 2011). Therefore, corruption control positively affects the economy both in low- and high-income countries (Zhou et al., 2020). Also, Arezki and Gylfason (2013) observe that the political institution in African countries determines the mechanism by which natural resource rents affect corruption. In less democratic countries, higher natural resource rents are associated with more government spending, indicating opportunities for political elites to corrupt government spending. A more in-depth study on the natural resources, namely on separating oil and non-oil resources, demonstrates that higher oil rents increase corruption (Arezki & Brücker, 2011; Okada & Samreth, 2017). Okada and Samreth (2017) suggest that this relationship does not arise with non-oil rents, because they are subject to public scrutiny. Meanwhile, Dong, Zhang, and Song (2019) observe a positive association between the abundance of coal and corruption in China.

Today, management of natural resources is challenging for many countries due to the irreversible effects of climate change. For example, global fish catch is predicted to be reduced at an additional rate of 3 to 13% by 2025 due to global warming (Cheung et al., 2016). Environmental degradation can reduce the availability of natural resources used for water, energy, and food under the condition of growing demand across the world. Many countries attempt to set proper natural resources management using multifaced approaches such as water-energy-food (WEF) nexus or the carbon economy due to its property as a public good, and thus managing natural resources may require suitable public interventions with sound institutions and effective good governance (World Bank, 2000). Environmental regulators need to optimize the policy instruments, especially the direct provision related to the natural resource as a public good (Sterner & Coria, 2011). Consequently, many studies observe that the political regime dictates how economic allocation from natural resource rent is distributed to society (Arezki & Gylfason, 2013; Bhattacharyya & Hodler, 2010; Daniele, 2011; Okada & Samreth, 2017; van der Ploeg, 2011).

Indicators are used to probe how countries successfully manage their performance. Most of them are multifaceted to display their capabilities to tackle the problems that plague the modern world. The Sustainable Development Goal (SDG) indicator, for example, is published by the Inter-Agency and Expert Group (IAEG-SDGs) UN to measure the implementation of the 2030 Agenda for sustainable development at the country level. It takes into account the interlinkage of economic, social, environmental, and political perspective dealing with humanity and the planet. Many scholars use SDGs to analyze and improve public policy for the environment (Cisneros-Montemayor et al., 2000; Kynčlová, Upadhaya, & Nice, 2020; Mulligan et al., 2020).

Another effective tool is the environmental, social, and governance (ESG) indicator, which measures the ESG performance of a country or a firm. Many studies focus on events at the firm level, and fewer studies focus on the country level. Employing ESG dataset from the Thomson Reuter Asset4, Zhou et al. (2020), for example, investigate how the development and adoption of firm-level ESG affect national macroeconomic performance in developed and emerging economies. It is undeniable that ESG performance promotes better financial development (Badía et al., 2019; Zhou et al., 2020).

This study employs indicators including the ESG sustainability ranking developed by RobecoSAM. The ranking takes into account 40 features of the environmental, social, and governance aspects at the country level, reflecting the strengths and weaknesses handling sustainability issues (RobecoSAM, 2020). The indicator tries to help us to understand the intertwined association of the environmental, social, and governance aspects of the country's performance, as does the SDG of the UN.

This study attempts to investigate empirically the emerging theme of how ESG performance and the quality of economic development affect natural resource rent. To the best of the author's knowledge as of mid-year 2020, there is no study examining the association of natural resource rent, ESG performance, and the quality of economic development. The interlinkage among ESG performance, corruption, and rent-seeking behaviour from natural resources is not yet understood. The previous study, however, shows that corruption can be acknowledged as one of many forms of rent-seeking behaviour (Arezki & Brückner, 2011; Bhattacharyya & Hodler, 2010). Using a unique data set of OECD countries from 2000 to 2017, this study intents to demonstrate empirically that the implementation of sustainability efforts could reduce natural resource rents. This paper, therefore, is the first empirical study to examine the effect of economic development and ESG performance on natural resource rent. The practical yield of this research could suggest that public policy instruments, i.e. foreign aid, are used to improve the ESG performance and thus bring a positive effect on economic development.

This paper consists of five different sections. Section 1 presents a review of previous studies and hypothesis development. Section 2 outlines data and the methodology to test the hypotheses. Section 3 provides the results and discussion of the empirical model. Finally, Section 4 concludes and addresses the way forward for the research on this topic for the future.

1. Literature review

1.1. Rent-seeking misbehaviour promotes corruption

A growing empirical economic study has been conducted to understand the relationship between natural resources and corruption. There is no doubt within the scientific community that corruption and weak institutions feed rent-seeking misbehaviour for natural resources.

Mehlum et al. (2006), for example, conclude that natural resources tend to be significantly correlated with human welfare in countries in which the institutional quality is lower. In addition, natural resources do not play a significant role in countries where institutional quality is higher. In those countries, other economic production factors (produced, human, and intangible) significantly determine economic outcomes (World Bank, 2006). Daniele (2011) observes that, in Botswana, where institutions are better managed than in Equatorial Guinea and DRC, natural resource rents promote sustainable economic growth and improve human development standards. Institutions in Equatorial Guinea and DRC are not able to set a limitation for the powerful elites to rule. Therefore, negative saving for the countries prevail, and rents from natural resources are used to serve other purposes. Massive rents drive domestic conflicts and fuel corruption in DRC, leading to negative impacts on economic development. In contrast, natural resource rent in Equatorial Guinea promotes outstanding economic development.

Using a data set of 157 countries, Okada and Samreth (2017) find that total natural resource rents increase corruption significantly, while non-oil natural resource rents do not. Oil rents increase corruption, and their impact is greater in countries with an intermediate level of corruption than in highly corrupt countries. Powerful elites with an intermediate level of corruption tend to exploit on a massive scale their rent-seeking actions from oil.

In their study on corruption and population health outcomes of 133 countries, Factor and Kang (2014) observe that corruption rises as GDP per capita falls, and the regime becomes less democratic. They use the CPI index of Transparency International, the control

of corruption index of World Bank, and the corruption index of the PRS Group as the corruption measures in their hypothetically defined structural equation modeling (SEM).

1.2. Unknown linkage between natural resource rent and ESG performance

No academic literature or empirical study has been conducted to draw the linkage between natural resource rent and ESG performance. This study uses natural resource rent published by the World Bank as part of the GDP percentage (World Bank, 2011). In their study, World Bank reveals that there is a high dependency among developing countries on natural resources as a share of wealth. The rent incorporates every natural resource including forest resources, oil, and gas. While the rent is calculated from the generated revenue from the extraction of natural resources. Therefore, higher externality costs from the exploitation of natural resource lower the rent.

Ben-Salha et al. (2018) suggest that natural resource rent promotes positive economic growth. They also find that bidirectional causality exists between economic growth and natural resource rent in the long run. This suggests that the interaction between two variables is not immediate. The country requires a sequence of events that may be affected by other economic parameters such as macroeconomics condition, political regime, or quality of institutions before the economy benefits from the revenues of natural resources.

In terms of ESG performance, there is no much to share. An ESG study conducted by Ho, Oueghlissi, and El Ferktaji (2019) shows a bidirectional causality between environmental and social performance and economic growth. They suggest that causality exists for high-income countries and implies that economic growth can help to determine whether CO_2 emission would increase or decrease.

1.3. Hypothesis development

This paper explores the relationship between corruption, ESG performance, human capital, and natural resource rents. It is evident from previous studies with datasets across the world that the wealth from natural resources is associated with corruption, especially in the less democratic countries with poor institutions (Arezki & Brücker, 2011; Arezki & Gylfason, 2013; Bhattacharyya & Hodler, 2010; Daniele, 2011; Dong, Zhang, & Song (2019); Okada & Samreth, 2017; van der Ploeg, 2011). This research employs natural resource rent indicators from the World Bank as the data set in which the measure of the rent is calculated using the percentage of real GDP. This rational has led this study to propose the path of how corruption can affect natural resource rent via economic growth (*H2* and *H3*). It is hypothesized that corruption control positively affects economic growth (*H2*) and thus, economic growth negatively affects natural resource rents (*H3*).

H1: ESG performance negatively affects natural resource rent

H2: Corruption control positively affects economic growth

H3: Economic growth negatively affects natural resource rent

Human capital has been considered an important economic parameter. Improved human development promotes sustainable economic growth and vice versa (Appiah et al., 2019; Khan, Ju, & Hassan, 2019; Kinnuen, Androniceau, & Georgescu, 2019; Maqin & Sidharta, 2017; Sinha & Sengupta, 2019). Ho, Oueghlissi, and El Ferktaji (2019) observe that

better ESG performance and corruption control lead to better economic growth. Therefore, we hypothesize that human capital positively affects ESG performance (*H4*) and corruption control (*H5*).

H4: Human capital positively affects ESG performance

H5: Human capital positively affects corruption control

It is foreseen challenges in testing the defined hypothesis. The data for ESG performance is usually at the firm level, not the country level. In response to the demand from corporations worldwide, some service providers, i.e. RobecoSAM has begun to offer country-level ESG performance to help increase understanding of macroeconomic effects. The data is not an aggregation of the firm's ESG performance; it is rather the collection of macroconditions, or known features, that are used to assess the risks when estimating the business performances or making decisions in a particular country. For example, Badía et al. (2019) evaluate the financial performance of government bonds using ESG dimensions employing the data set of RobecoSAM's ESG rating for 24 countries. While Thomson Reuter Asset4's data consists of ESG rating from over 6,500 firms. The rating is concluded from 400 ESG metrics across 10 different pillars. Previous studies have intensively employed the data (Eccles et al., 2014; Ioannou & Serafeim, 2012; Ioannou et al., 2014), but only Zhou et al. (2020) calculate the aggregate ESG rating of firms at a given country to draw conclusions at the country level. Nevertheless, this study aims to test the linkage between national resource rent, ESG performance, and corruption at the country level.

2. Methodological approach

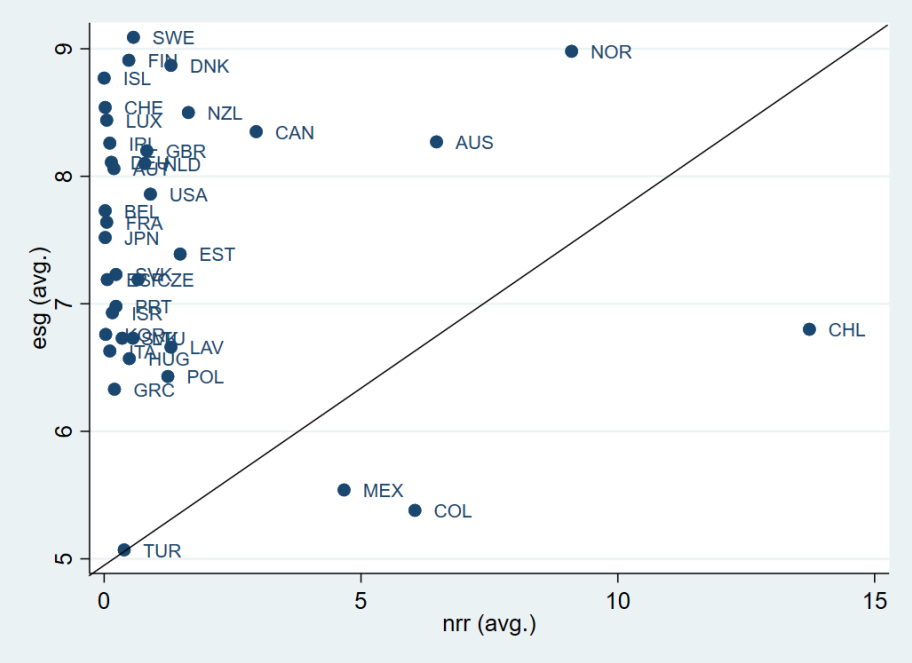
2.1. Data

The date set consists of ESG, natural resource rent, the Corruption Perceptions Index (CPI), Gross Domestic Product per capita (GDP), and the Human Development Index (HDI). It covers 37 OECD country members for a period ranging from 2000 to 2017. By the time of writing this research, the best available data set period is only until 2017. Therefore, there are 666 data points in this paper.

To determine ESG performance, this study employs the data set sourced from RobecoSAM. The score is on a scale from 1 to 10, in which higher value indicates higher ESG performance. In addition to ESG sustainability rating, the data set also contains the dimensions of environmental, social, and governance (ESG). These dimensions are also measured on a scale from 1 to 10, in which higher value indicates a higher level of respective sustainability coverage. To bring the ESG sustainability rating to the table, RobecoSAM uses different weights for each dimension and sums the dimensions against their weights. It is acknowledged that, so far, the data set has been employed only by Badía et al. (2019) and Hübel (2020) for their studies that examine data at the country level.

The natural resource rent data is sourced from the World Bank and represents the GDP's percentage value from the rent for natural resources. In the data set, the percentage is omitted so that the value is on a scale from 0 to 100. CPI score is taken from Transparency International, representing the corruption control. It is worth note that the CPI score from 2000 to 2011 is on a scale from 0 to 10. Transparency International changed the scale from 0 – 10 to 0 – 100 in 2012. Therefore, this study multiplies the CPI score from 2000 to 2011 by 10 to match the scale from 2012 onward.

This study employs the real GDP number from the World Bank representing economic growth. Some scholars use GDP per capita in their studies to investigate the rent-seeking behavior of natural resource rent and economic growth (Ben-Salha et al., 2019; Bhattacharyya & Hodler, 2010). Others use the real GDP number (Guan et al, 2020). Lastly, HDI from the UNDP is used and represents human capital. The HDI score is on a scale from 0 – 1, where the higher figure indicates higher human development. This UNDP's score has incorporated not only an economics dimension but also improvement in human well-being (life expectancy and education). Graph 1 plots the average natural resource rent and ESG performance. It can be observed that Chile, Colombia, Mexico, and Turkey lie in the lower quadrant of the matrix.



Graph 1. Natural resource rents and ESG performance for OECD countries
Source: *own compilation*

Table 1. Descriptive statistics for the data set

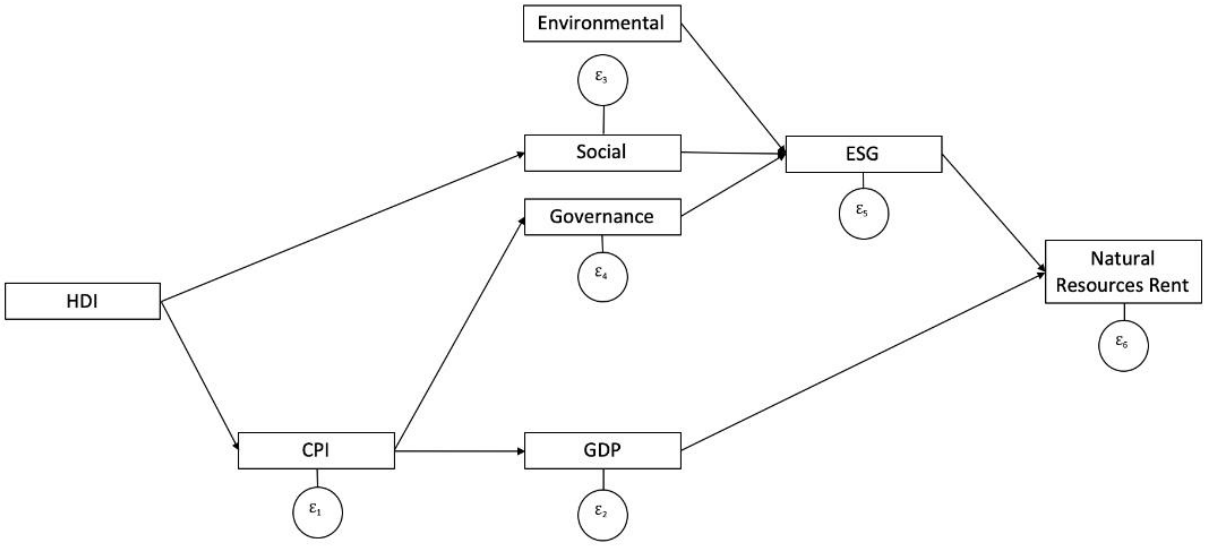
Variable	Number of observations	Mean	Standard Deviation	Minimum	Maximum
ESG	666	7.48	1.03	4.89	9.16
Environmental	666	7.29	1.09	4.83	9.68
Social	666	7.35	1.19	4.23	9.57
Governance	666	7.43	0.93	4.75	8.7
Natural resource rent	666	1.55	3.06	0	21.39
CPI	666	67.67	18.52	29	100
GDP	666	1,133.13	2,525.47	5.69	19,485.39
HDI	666	0.86	0.06	0.65	0.95

Source: *own compilation*

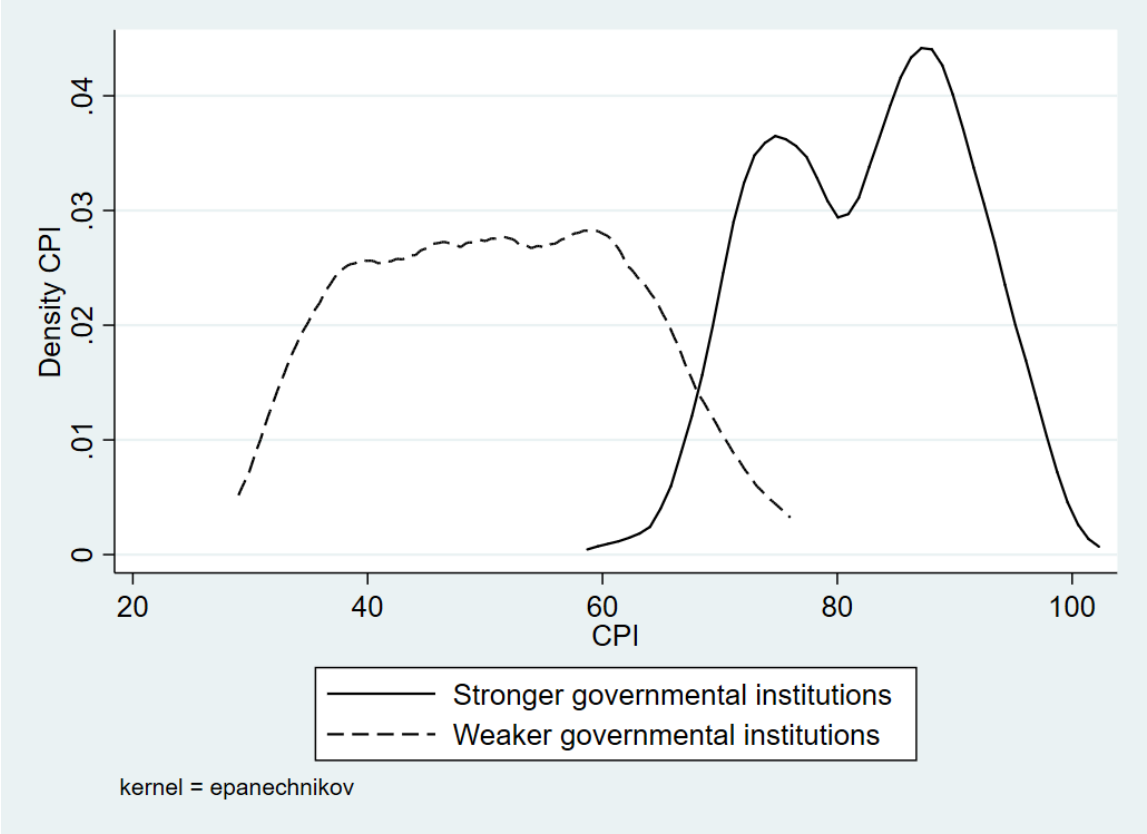
3. Methodology

This study tests the hypothesis using the path analysis model to examine the relationship between different observed variables. The model is a combination of multiple regressions and factor analysis. It can examine a set of relationships between one or more

independent variables, either discrete or continuous, and one or more dependent variables, either discrete or continuous (Ullman, 1996). The path analysis model has been widely used in numerous recent empirical economic-related studies (Jomnonkwao, Uttra, & Ratanavaraha, 2020; Ji, Zhou, & Tian, 2019; Park & Choi, 2019; Shen et al., 2021; Sutthichaimethee & Dockthaisong, 2018).



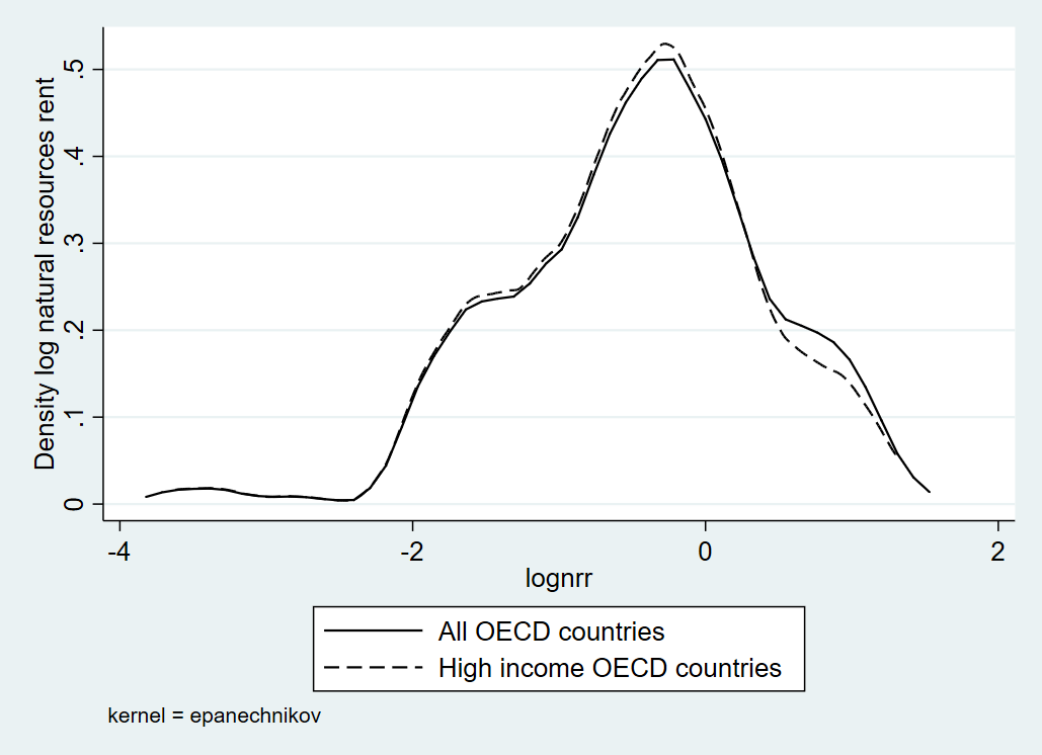
Graph 2. Specification of path analysis model
Source: *own compilation*



Graph 3. Corruption control distribution based on governmental institution
Source: *own compilation*

The features of the path analysis model used in this study are similar to structural equation modeling (SEM) however without the presence of a latent variable (Norman & Steiner, 2003). A latent variable is a variable that cannot be directly measured. Other observed variables, therefore, must be considered to conclude the latent variable. The latent variable in SEM also accounts for measurement error. The path analysis model, therefore, assumes that all observed variables are measured without any error. Many scholars refer to the path analysis model as SEM in their studies. Indeed, many use the same module for the path analysis model and SEM in statistics software. This study uses STATA.

In this study, a model is specified to test the hypothesis, as described in Sec. 2. The model consists of eight measured variables with two exogenous variables, namely HDI and environmental, and six endogenous variables, namely CPI, GDP, governance, social, ESG, and natural resource rent (see Graph 2). There are six regression coefficients (ε) for CPI (ε1), GDP (ε2), governance (ε3), social (ε4), ESG (ε5), and natural resource rent (ε6) associated with the six regressions in this model.



Graph 4. Natural resource rent distribution based on economy size
Source: *own compilation*

In the model, ESG performance and economic growth have a direct path to natural resource rent so that this study can test H1 (ESG performance negatively affects natural resource rent) and H3 (economic growth negatively affects natural resource rent) using this direct path. RobecoSAM's ESG performance depends on the environmental, social, and governance dimensions. Human capital is part of RobecoSAM's social dimension, in addition to other indicators such as education, health, gender equality, and happiness rankings (RobecoSAM, 2020). Therefore, it is presumed that there is a direct path from human capital to the social dimension. Likewise, the governance dimension also takes into account corruption control (RobecoSAM, 2020). There is a direct path from CPI to governance.

To produce sensitivity analysis, this study uses an additional data set by controlling the quality of institutions and the economy size. The first screening is conducted by separating countries with stronger governmental institutions and weaker governmental institutions. Graph 3 shows the corruption control distribution in countries with stronger and weaker governmental institutions. This study uses the value of governance performance for the grouping. Countries with stronger governmental institutions have governance performance above average (> 7.4), while weaker governmental institutions have governance performance below average (< 7.4). The corruption control distribution of countries with stronger governmental institutions does not follow normal distribution, and rather exhibits a bimodal distribution. Okada and Samreth (2017) also observe a similar pattern when they analyze the corruption distribution.

The second screening is conducted by grouping only high-income OECD countries (see Graph 4). This implies that this research excludes countries classified as middle-income countries such as Chile, Columbia, Mexico, and Turkey. The exclusion seems to represent the finding this study has with these countries with regard to the plot of natural resource rent versus ESG performance (see Graph 1). This study uses the logarithmic value of natural resource rent to compress the scale so that the change in the natural resource rent density can be observed easily. It is found that the natural resource rent distribution between only high-income countries and all countries looks almost like normal distribution. There is a negligence effect from middle-income OECD countries to the distribution curve.

4. Results and discussions

This study runs a correlation matrix for the measured variables used in the path analysis model. The result will help us reconfirm our specification of the path analysis model. Table 3 shows the correlation matrix. It is observed a significant correlation between human development and other measured variables. All correlations are positively significant, except for natural resource rents, in which the correlation is negatively significant. This implies, to some extent, that the development of human capital is more likely to decrease natural resource rent. A positive significant correlation between human capital and ESG performance brings us to the indication that, as human development is progressing toward better direction, ESG-related issues could be considered in designing institutions.

This study does not observe any correlation between economic growth and ESG performance. Economic growth, however, can lead to poor environmental management, as the correlation between GDP and environmental is negatively significant. On the other hand, better institutional setups might promote economic growth. There is a significant positive correlation between GDP and governance. Bhattachrayya and Hodler (2013) suggest that democratization, as a good governance element, can help economic growth, especially in resource-rich countries.

This research also finds a weak negative correlation between economic growth and natural resource rent as shown in Table 2. Economic growth can reduce natural resource rent by 0.080. Van der Ploeg (2011) suggests that resource-rich developing countries seem unable to successfully utilize their resources for other productive assets. This study argues that institutional setups in OECD countries, in term of environmental and governance, have led to better resource allocation management, and as such, all externalities can be internalized in the rent costs. Waldo et al. (2016) conclude that implementing regulatory instruments for externalities in Nordic countries may have a significant effect on economic performance. Meanwhile, Libecap (2018), from a broader perspective, argues that the economic welfare losses for addressing externalities are mostly due to hidden transaction costs for the political process. Addressing externalities in the policies is, however, multifaceted. If the responsibility

of the policy is divided across multiple government levels, it is most likely that the use of policy instruments is not widely implemented (Lindsey & Santos, 2020).

Table 2. Correlation matrix

	Natural resource rent	CPI	GDP	ESG	Environ-mental	Social	Govern-nance	HDI
Natural resource rent	1.000							
CPI	0.025	1.000						
GDP	-0.080*	0.091*	1.000					
ESG	-0.071	0.928***	0.070	1.000				
Environ-mental	-0.102*	0.694***	-0.113**	0.834***	1.000			
Social	-0.079*	0.875***	0.088*	0.956***	0.739***	1.000		
Govern-ance	-0.041	0.944***	0.122**	0.965***	0.718***	0.889***	1.000	
HDI	-0.161***	0.757***	0.205***	0.830***	0.596***	0.832***	0.816***	1.000

Source: *own compilation*
Notes: *significant at the 10 percent level, **significant at the 5 percent level, and ***significant at the 1 percent level.

Table 3 shows regression estimations for 37 OECD countries. Using unstandardized estimations, this study observes that better corruption control increases economic growth. The correlation between CPI and GDP is positively significant ($p < 0.001$). This finding is consistent with existing studies (Bhattachrayya & Hodler, 2013; Daniele, 2010; Factor & Kang, 2014). There is no statistical evidence for the relationship between ESG, GDP, and natural resource rents. Also, this study does not observe the relationship using the correlation matrix (see Table 2).

Table 3. Path analysis model regression estimations for 37 countries from 2000 to 2017

Model		Regression estimation		
Control variable	Dependent variable	Unstandardized coefficient	SE	*p*
ESG	Natural resource rent	-0.194	0.114	0.089
GDP	Natural resource rent	-0.00009	0.00004	0.052
Environmental	ESG	0.203	0.003	0.000
Social	ESG	0.314	0.005	0.000
Governmental	ESG	0.541	0.005	0.000
CPI	GDP	12.385	5.262	0.019
HDI	CPI	241.979	8.101	0.000
Governance	CPI	0.047	0.001	0.000
HDI	Social	17.219	0.445	0.000

Source: *own compilation*

In OECD countries with stronger governmental institutions (see Table 4), however, there is negative significant correlation between ESG performance and natural resource rent ($p< 0.005$). Better ESG performance reduces natural resource rent. The institutional setups may not only have addressed externalities issues in the policy design, but also have been

increasing nationwide awareness of dealing with ESG problems. One study in Pakistan suggests that regulators should maintain a certain level of quality for the institutions to optimize financial returns from the natural resource rent (Khan et al., 2020). Private sectors recognize such efforts to handle environmental economics as the financial cost of climate change (Crabb, 2020) or responsible investment (Harnett, 2018). The risks for the businesses from environmental problems rise with climate change. In the case of OECD countries with weaker governmental institutions, this study observes that such a conclusion still prevails (see Table 5).

Table 4. Path analysis model regression estimations for countries with stronger governmental institutions from 2000 to 2017

Model		Regression estimation		
Control variable	Dependent variable	Unstandardized coefficient	SE	*p*
ESG	Natural resource rent	-1.096	0.367	0.003
GDP	Natural resource rent	-0.0001	0.00005	0.003
Environmental	ESG	0.213	0.003	0.000
Social	ESG	0.312	0.004	0.000
Governmental	ESG	0.524	0.010	0.000
CPI	GDP	-145.756	19.954	0.000
HDI	CPI	77.249	14.685	0.000
Governance	CPI	0.031	0.001	0.000
HDI	Social	15.303	1.081	0.000

Source: *own compilation*

Table 5. Path analysis model regression estimations for countries with weaker governmental institutions from 2000 to 2017

Model		Regression estimation		
Control variable	Dependent variable	Unstandardized coefficient	SE	*p*
ESG	Natural resource rent	-1.296	0.214	0.000
GDP	Natural resource rent	-0.0003	0.0002	0.061
Environmental	ESG	0.191	0.004	0.000
Social	ESG	0.308	0.005	0.000
Governmental	ESG	0.548	0.007	0.000
CPI	GDP	2.044	3.447	0.553
HDI	CPI	117.811	9.167	0.000
Governance	CPI	0.046	0.001	0.000
HDI	Social	10.570	0.521	0.000

Source: *own compilation*

The effect of economic growth on the natural resource rent cannot be observed for OECD countries ($p > 0.05$) in this study. If the countries with stronger governmental institutions are taken into account, there is a negative significant correlation between economic growth and natural resource rent ($p < 0.005$). There is a decreasing percentage of GDP from natural resources for every increase in economic growth. Otherwise, analyzing the

model using sample of countries with weaker governmental institutions, this study observes no correlation (p> 0.05). Therefore, it is suggested that the quality of governmental institutions may play an important role in how economic growth can be fueled from other income streams rather than from natural resource extractions. Many, however, agree that the revenues from natural resource extraction can be used to promote economic growth and strengthen capitalization (Yıldırım et al., 2020; Zaidi et al., 2019). Implementing the measures to promote better ESG performance is statistically significant for the countries with stronger governmental institutions (p< 0.005) to reduce the rent from natural resource extractions.

Table 6. Path analysis model regression estimations for high-income OECD countries from 2000 to 2017

Model		Regression estimation		
Control variable	Dependent variable	Unstandardized coefficient	SE	*p*
ESG	Natural resource rent	-0.3	0.111	0.070
GDP	Natural resource rent	-0.00008	0.00004	0.053
Environmental	ESG	0.204	0.003	0.000
Social	ESG	0.314	0.004	0.000
Governmental	ESG	0.541	0.005	0.000
CPI	GDP	12.969	5.396	0.016
HDI	CPI	241.032	8.293	0.000
Governance	CPI	0.048	0.0006	0.000
HDI	Social	17.162	0.457	0.000

Source: *own compilation*

Considering high-income OECD countries, such an observation does not exist (see Table 6). There is no significant correlation between ESG and natural resource rent (p> 0.05). This further confirms that there is an absence of correlation between the portion of revenue from natural resource extractions and ESG performance in high-income countries. It is suggested that countries with stronger governmental institutions, not with advanced economy development, are more likely to reduce natural resource rent. These economic actors tend to avoid taking benefit from the misbehavior of rent seeking due to improve the quality of institutional setups. This is further confirmed with a significant correlation between CPI and GDP for the countries with stronger governmental institutions (p<0.001).

Is natural resource rent the cause or the effect?

To complete this study, the Granger causality test on economic growth, ESG performance, and natural resource rent is performed. The modeling result indicates statistical evidence of a relationship between natural resource rent and ESG performance. Using a sample of OECD countries with stronger governmental institutions, a significant correlation between natural resource rent and ESG performance is found.

The lag of two periods is selected in this study. The robustness of autoregression using the Lagrange-multiplier and Jarque-Bera test is then tested. This study finds that no autocorrelation is detected in the data set using the Langrage multiplier. In addition, the Jarque-Bera test confirms that the disturbances in the autoregression cannot be observed. The null hypothesis of normality for natural resource rent, ESG, and GDP growth cannot be rejected. Also, the regressions regarding whether they satisfy the stability condition is tested.

All of the eigenvalues lie inside the unit circle. Therefore, the autoregressions satisfy the stability conditions. Table 7 shows Granger causality.

As can be seen, the null hypothesis of no Granger causality due to the lagged value of ESG performance to natural resource rents cannot be rejected ($p< 0.005$). This study observes also that the null hypothesis of no Granger causality due to the lagged value of natural resource rent to ESG performance cannot be rejected ($p< 0.005$). It is therefore concluded that there is evidence of bidirectional Granger causality for natural resource rent and ESG performance.

Table 7. Granger causality test for natural resource rent, ESG, and GDP

Variable	Excluded	Chi2
Natural resource rent	ESG	6.669**
	GDP	1.741
ESG	Natural resource rent	6.211**
	GDP	5.185
GDP	Natural resource rent	8.047**
	ESG	5.260**

Source: *own compilation*
Notes: *significant at the 10 percent level, **significant at the 5 percent level, and ***significant at the 1 percent level.

The data set also shows directional Granger causality for GDP growth due to ESG performance ($p< 0.005$). ESG performance for OECD countries affects economic growth. Using the data set of 118 countries, Ho, Oueghlissi, and El Ferktaji (2019) find a bidirectional relationship between economic growth and ESG performance.

Conclusion

In conclusion, this study presents the findings that not all of defined hypothesis can be proved using the model. Using the data set of OECD countries from 2000 to 2017, we observe that corruption control positively affects economic growth (*H2*), and human capital positively affects ESG performance (*H4*) and corruption control (*H5*). The development of human capital is deemed to be important for the quality of economic development; for example, it improves ESG performance and corruption control. An educated society can promote the quality of institutions to run the business and govern the country.

The hypothesis that ESG performance negatively affects natural resource rent (*H1*) is rejected when the data set of all OECD countries is used. Using the sample of OECD countries with stronger governmental institutions, this study however can accept this hypothesis. It is suggested that ESG indicators including climate change mitigations, economic inequality, and rule of law have been valued in institutional setups. Moreover, this study argues that the internalization of externality costs for natural resource exploitations have been addressed in the financial calculation, and as such, the costs decrease the value of rents.

The model rejects the hypothesis that economic growth negatively affects natural resource rent (*H3*). However, it is found a weak negative correlation between economic growth and natural resource rent. This aligns with recent studies addressing how the economy can grow under the pressure of sustainability efforts (Libecap, 2018; Waldo et al., 2016).

Lastly, the empirical result of this study shows a bidirectional Granger causality between natural resource rent and ESG performance. This supports the finding using a specific sample of OECD countries that the correlation is negative between ESG performance

and the portion of revenue from natural resources. We suggest that ESG performance is more likely to be affected by the quality of institutions rather than the size of the economy for OECD countries. This is consistent with the suggestion of Khan et al. (2020) that the quality of institutions is the key to optimal financial development.

This paper has met its objective as the first study to shed light on how natural resource rents interlink with ESG performance and the quality of economic development at the country level. More compelling reasons exist for governmental and business institutions regarding the importance of ESG in navigating the modern economy. It is hoped that this study can bring insight to help policymakers design effective policy instruments in managing natural resources and the business actors to make optimal decisions for running their business. Effective natural resource management is the key to promote not only economic growth but also financial development (Guan et al., 2020). Also, it is imperative that the policy instruments are set up to balance costs and benefits fairly (Sterner & Coria, 2011). Furthermore, this study includes additional insights into corruption control regarding natural resources, whereas many scholars have dedicated their time to revealing whether it is indeed a curse or a blessing.

For future research, it would be interesting to study more specifically how sustainability efforts affect specific natural resource rents; for example, oil rent or forest rent. Also, many institutions have incorporated climate change risks to mitigate the impacts of these elements at all costs. The heterogeneity pattern of natural resources shapes how the economy is developed in each country. The curse of natural resources is still a growing debate among the scholars. The finding of this study that observes bidirectional Granger causality for natural resources and ESG performance shows that the underlying mechanism to paint the bigger picture in term of economic performance is yet to understand. This study believes that understanding sectoral analysis on natural resources would provide a better understanding of how ESG performance can dynamically affect economic growth.

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Annex

Annex 1. OECD country members involved in the study

Australia (AUS)	Estonia (EST)	Israel (ISR)	Netherlands (NLD)	Sweden (SWE)
Austria (AUT)	Finland (FIN)	Italy (ITA)	New Zealand (NZL)	Switzerland (CHE)
Belgium (BEL)	France (FRA)	Japan (JPN)	Norway (NOR)	Turkey (TUR)
Canada (CAN)	Germany (DEU)	Korea (KOR)	Poland (POL)	United Kingdom (GBR)
Chile (CHL)	Greece (GRC)	Latvia (LVA)	Portugal (PRT)	United States (USA)
Colombia (COL)	Hungary (HUN)	Lithuania (LTU)	Slovakia (SVK)	
Czech (CZE)	Iceland (ISL)	Luxembourg (LUX)	Slovenia (SVN)	
Denmark (DNK)	Ireland (IRL)	Mexico (MEX)	Spain (ESP)	

Source: *own compilation*