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Environmental Policy Stringency as a Catalyst for Breaking the Resource Curse Phenomena: Empirical and theoretical insights from the top ten green economies

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Abstract

The study aims to determine whether environmental policy stringency (EPS) help countries in breaking the resource curse phenomena. This paper integrates environmental policy stringency (EPS), resource development of resource and economic growth in a unified approach by introducing endogenous model of growth with four sectors. Next, the study calculates the coefficients of resource curse of ten top green economies namely Sweden, Denmark, United Kingdom, Switzerland, Ireland, France, Iceland, Norway, Finland, and Costa Rica. Ultimately, the focus of this research is to examine the impact of environmental policy stringency (EPS) on resource curse and its mechanisms. The results showed that there are four countries with highest resource curse coefficient and four countries with lowest coefficient of resource curse. Ireland, Iceland, Costa Rica, and Norway are the four economies with the higher coefficient of resource curse. These countries heavily depend on natural resources for manufacturing but their inefficient utilization. Moreover, the results indicate presence of inverted U connection between EPS and resource curse. Put simply, findings show that turning point exist when EPS mitigates the adverse effect of resource curse. Furthermore, the study if EPS reaches at a certain level, EPS helps economies in mitigating the adverse consequences of resource curse. This paper also uncovered that in full samples both market based and non-market based environmental policies can help to indirectly break the resource curse though accelerating the development of manufacturing, promoting the level of green technologies, minimizing the greater dependence on natural resources. Researchers also recommended that the government should enact stringent and stronger environmental policies for protection of the environment. Implementing this measure will have a beneficial effect on the overall environment as well as the whole green economies.

Keywords: Environmental Policy Stringency; Recourse Curse; Development of Resource; Technological innovations; Green Economies

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1.Introduction

Environmental Policy Stringency (EPS) includes those policies that develop environmental regulations, and limit air pollution and any emissions of greenhouse gases. The policy effort can be made more effective and successful through the adoption of clean technological innovations. The measures of environmental policy stringency are also different, also known as units. EPS includes market and non-market-based policies i.e., certificates, taxes, performance standards, etc. Also, technological support measures are included such as support for the adoption of wind and solar and other R&D expenditures (Frohm et al., 2023). Additionally, the OECD defined the index of Environmental policy stringency as an international as well as country-specific measure for indicating the price of any harmful actions/ behaviors towards making the environment polluted. Moreover, EPS presents solutions related to incentives, green taxation, and technological development and assists in the use of renewable energy consumption with the requirement of compliance levels. They enforce energy-efficient behaviors, mechanisms for carbon pricing, GHG emissions reduction, renewable energy implementation, and lowering the emissions targets (Mihai et al., 2023; OECD, 2023).

The negative externality includes a polluted environment with more carbon emissions. Well-developed policies and laws are essential to be designed and implemented by enterprises, governments, and citizens for emissions reduction. The Resource curse Phenomenon is attracting the attention of researchers across the globe, especially in resource-rich regions. Countries' economic growth is mainly leading to a lot of resource utilization, thus negatively impacting environmental safety, resources, and production efficiency (Yirong, 2022). Moreover, this natural resource curse hypothesis points to the influence of natural resources negatively on economic growth and is also said to be the “paradox of plenty”. While the natural resource curse phenomenon can be changed into a blessing (sustainable development and good institutional quality) through the enforcement of renewable sources use and natural resource utilization (Ahmad et al., 2023). Natural resources are basically things that are extracted from natural environment and are helpful in daily basis activities. These natural resources are unfortunately converted into the resource curse than blessing and therefore affecting the whole planet (Lashitew and Werker 2020).

The natural resource curse phenomenon indicates that sometimes the growth and efficiency of countries with few resources is better than those with abundant resources. The example of countries that have good resources but still are not showing significant growth include Mexico, Nigeria, Venezuela and other gulf states (Shah et al., 2022). On the other side, researchers and scientists are continuously struggling to find out significant ways to break the resource curse hypothesis. For instance, it is noted that as high resource dependence is directly linked with exaggerating the resource curse issue, thus the resource dependence of countries must be lowered. Through reducing the resource dependence of countries, the Dutch disease could also be mitigated which indicates a negative association between economic development and natural resources. Moreover, it is also elucidated that technological innovations could also reverse the resource curse and reduce carbon emissions. This may include investments in science and technology

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and the introduction of the high-speed rail (HSR) (Luo, Wang and Liang, 2022). It is important for countries to optimally utilize their natural resources by using different short- and long-term strategies. The issue could be handled through fiscal measures that is a part of strong environmental policies. The resource allocation could be improved through properly designed spending measures and tax systems that help move towards a sustainable path, improve life quality, and reduce climate risks and negative impacts.

The manufacturing industries may benefit significantly from technologies that reduce carbon emissions and are more environmentally friendly, and these ideas can be encouraged by a well-planned environmental policy. The reduction in carbon emissions in manufacturing industries also breaks the resource curse that is supported through incorporating technological innovations and environmental policy that is well planned and developed. The green technology that benefits the environment is essential to use as it saves the compliance cost on environmental legislation internationally. The green technological breakthroughs help countries in adopting more environment-conscious behaviors, thus regulating the resource dependence level and benefiting ecological footprints of a country (Dai and Du, 2023). Similarly, it is stated that Information and Communication Technologies (ICTs) are a way forward towards breaking the resource curse and help in economic growth. The resources abundance could be utilized by the countries in a positive way through adopting "technology driven natural resource growth" that let the resources be a blessing for countries (Anser et al., 2020).

Green technological innovations lead to economic vitality through improving the construction of ecological civilization and through reducing the emissions of pollutant. The technological upgrade promotes the utilization of natural resources in a sustainable manner that help in breaking the resource curse. The production efficiency is also widely improved through the green technological innovations (Tian and Feng, 2023). The human capital accumulation is another factor in the resource's development and efficient use. The lack of human capital leads to the crowding out effect thus initiating a resource curse and negatively influence economic growth. This is also due to the reason that manufacturing development ceases that is a predominant factor in economic growth and for natural resources proper use (Shao and Yang, 2014). Importantly, this environmental policy stringency is needed to be implemented by countries in order to break the resource curse and proper utilization of resources in a way that it benefits the economy. These policies also help in the implementation of carbon taxation and thus reduce carbon emissions improving the quality of environment. The environmental policy enforces the use of renewable energy and a carbon taxing system that curbs the emission of carbon. Thus, eco-friendly technologies are encouraged to develop a carbon free society that break the resource curse phenomenon (Wolde-Rufael and Mulat-Weldemeskel, 2021).

It is argued that the downturn of this resource curse hypothesis arises from a lack of environmental policy stringency comparable and reliable measures. Moreover, no proper policy is yet developed to break the resource curse in order to improve economic growth. Thus, this research paper is destined to fill this gap by covering the essential topic of resource curse phenomenon and for that the causes that bring

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forth this issue are evaluated. Notably, the importance of Environmental Policy Stringency (EPS) and its impact on resource curse hypothesis, an area that is important to be researched, will be analyzed. This paper also describes how Environmental Policy Stringency can break resource curse through a reduction in the resource dependence of countries, accelerating manufacturing development, improving green technological innovation level and other policy measures. The combination of all these factors are researched for the first time, presenting recommendations for the policy makers and other government authorities to take significant actions for the reduction of carbon emissions and for environmental safety. These are the study's contributions that make this research worthwhile. For fulfilling the aim of this study, the paper will explore the top ten green economies from period of the year 1990 to the year 2020 (310 observations) by using a two-step system GMM estimator. This estimator deals with variable bias and endogeneity and is a part of dynamic panel data models.

2. Literature review

2.1. Environmental Policy Stringency (EPS) and economic growth

The existing studies examining the impact of Environmental Policy Stringency on economic growth can be divided into various groups. The first category is innovation's compensation effects. Companies are inclined to purchase more clean technology and clean energy because of the implementation of stringent environmental policies. As the number of customers, buying products increases, businesses are more drive to create and innovate environmentally friendly production processes for their products as they expect their novel ideas to generate more revenues on investments as compared to the costs to develop those ideas (Zhang et al., 2022). Johnstone et al., (2022) mentioned that EPS prompts companies find novel methods of minimizing pollution in order to avoid excessive expenditures of compliance. This implies that EPS has potential to inspire technological innovations, innovative solutions and fresh insights, ultimately enhances economic growth. Similarly, Ahmed (2020) discovered that EPS encourage countries to innovate eco-conscious initiatives for being more environmentally sustainable. In addition, implementing stringent environment policies supplemented by adopting innovative green strategies can assist in achieving sustainable economic growth. Likewise, the Porter hypothesis also posits that stringent policies of environment spur technological innovations and enhance business's productivity (Porter, 1991), ultimately enhance economic growth. The second main point is to consider is the compliance expenses effects. Implementing sticker policies not only cause countries to incur higher manufacturing expenses (Feng et al., 2021), but also pose challenges to their competitiveness in the world market, therefore decelerate the economic growth of the countries (Arjomandi et al., 2023). Zarzoso et al., (2019) reported that EPS lead businesses to make more investments on research and development, ultimately driving in higher patent creation. This is further demonstrated by the fact that companies are averse to green taxes and seeking methods to decrease their tax burden or expenses. The other category of literature review is uncertainty theory. Rufael and Weldemeskel, (2021) discovered that inverted U-shaped relationship exists between EPS and emission

levels. This implies that initially EPS result in environmental deterioration. However, when a particular threshold is reached, EPS can effectively decrease the pollution level, suggesting that strict environmental polices lead to reduce environmental deterioration. Another study by Arjomandi et al., (2023) found that investing in environmental projects and implementing stringent environmental policies have long-term negative impact on the productivity and economic growth.

2.2. Natural resources and economic growth

Kuang et al., (2023) discovered that countries abundant in natural resources do not always experience economic growth compared to those with fewer resources. Numerous studies published debating whether natural resources are curse or blessing for a country. However, studies on whether having lot natural resources are always blessing or not have provided inconsistent and mixed results. Several research studies (e.g., Xiaoman et al., 2021; Wang et al., 2022; Lashitew and Werker, 2020) supported and confirmed the theory of resource curse. Akinbo (2021) pointed out that an abundance of natural resources limits the economic growth of many developed as well developing countries. There is further evidence indicating that overreliance on natural resource impede economic growth and turn them into a burden instead of blessing or advantage (e.g., Sharma and Mishra, 2022; Inuwa et al., 2022; Wang, 2021; Miamo and Achuo, 2022). Other researchers provided reasons why an excess of resources can become a curse in certain areas. For example, According to Lee et al., (2023), this is due to fact that natural resource detracts focus and investment from areas such as advancement in human capital or education and technological innovations. In addition, Imran et al., (2024) stated that natural resources result in resource curse as certain countries overemphasize the production of goods manufacture from these resources because of corrupt practices and the pursuit of financial gain. Alssadek and Benhin (2023) mentioned that resource curse happens because of few reasons: poor institutions, Dutch diseases, lack of investments in human capital, slow economic growth. In contrast, many studies argued that theory of resource curse idea does not hold true. For example, Hayat and Tahir (2021) argued that having abundance of natural resources could contribute to the economic growth of many nations. Many other studies have found same results. Khan et al., 2022; Miamo and Achou, (2022). Likewise, Xu et al. (2016) reported that abundant natural resources could enhance country's economic growth because nations abundant of natural resources have the ability to produce goods and engage in international trade resulting in accelerated generation of revenues ultimately enhance the economic growth. Baafi (2024) argued that when country is over reliance of resources surpasses at a certain point usually hinder economic growth instead of promote it. Zheng et al., (2023) confirmed the idea of inverted U connection between country's abundant resources and its economic growth. Additional studies focused on addressing the issue of resource curse. Yang and Song, (2019) utilized empirical analysis along with theoretical framework in order to show that social capital help countries in breaking or addressing the issue of resource curse. In their study, social capital was identified to be catalyst for technological innovations and advancements, though this research, the environmental factor was not taken into account. In addition to these, Feng et al.,

(2024) stated that fostering technological innovations and enhancing economic freedom potentially counteract the issue of resource curse however, this statement lacks sufficient backing.

2.3. Environmental Policy Stringency (EPS), natural resources and economic growth

Few researchers analyze how Environmental Policy Stringency (EPS), natural resource abundance and economic growth interact with one another. Available literature can be divided into different distinct groups. Multiple researchers examined the availability and abundance utilization of natural resources and environmental efficiency. The use of environmental efficiency in management of resources measure how efficiently different resources are utilized without harming the surrounding environment (Wang and Chen,2020). Several studies reported that areas abundant in natural resources frequently experience challenges referred to as "the resource curse". This phenomenon indicates that the wealth of resources does not always lead to economic prosperity and may even sometimes have adverse effects on the environmental quality (Hesary et al., 2019; Zhang et al.,2024). In contrast; some researchers argued that proper and effective management of resources may lead to sustainable growth (Lee et al.,2021, Sun and Gao, 2023). Moreover, few studies have been conducted to examine the connection between natural resource abundance, Environmental Policy Stringency and economic growth. Guan et al., (2022) asserted that the developmental and organizational approaches of industrial structures significantly influenced by the implementation of strict environmental policies and endowment of resources in nonlinear way. Qamruzzaman (2024) reported that the overabundance of resources can be detrimental to the environmental quality and pose challenges for countries in achieving economic growth, but implementation of environmental policy stringency can contribute to a more sustainable economy. Despite taking into account the environmental policy stringency, resources as well as the economy collectively, they lack enough backing for the model and neglect to consider the phenomena about how EPS effect the endowment of resources. Moreover, some scholars focus on studying the economic reasoning using mathematical models. Timilsina et al., (2018) investigated that potential repercussion of altering coal tax related policies on resource consumption, economic and environmental aspects. They employed CGE model to project the outcomes of various tax policies overtime. Their study discovered that implementing subsidies and various taxes on coal could lead to more efficient utilization of resources, cleaner and sustainable environment, ultimately minimizing the issues associated with the resource curse. They provided the reasoning mechanism among environmental policies, overseeing the management of resources and promoting economic growth. However, the model's simplicity fails to represent the real scenario due to lack of enough data or literature to support it.

Despite numerous researchers have looked at the phenomena of resource curse and the mechanisms behind it, but there are still areas that have not been completely covered and investigated. Firstly, there are limited studies that have investigated the influence of environmental policy stringency on resource curse. Secondly, earlier

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studies have not provided a comprehensive and satisfactory explanation of how to tackle the issue of resource curse. Thirdly few researchers have done studies on how stringent environment policies natural resource dependent on the economic performance of top green economies. In light of these limitations, the present research explores the interconnectedness of environmental policy stringency, abundant resources and economic growth.

3. Theoretical analysis

The focus of this article on three different part of economic system which involves Research and development sector, resource development economy and manufacturing sector. Additionally, this study includes the protection of environment sector to see whether environmental policies can help mitigate the problem of resource curse. Consider a scenario, where there is a group of labor with the ability of carrying out the homogenous task in the economy. There is no extra cost for transitioning between manufacturing to development of resource sectors. The way the economic system operates in the following manners: Initially, employing the current technology, manufacturing industry utilizes materials, resource-based goods and labor force to create different final goods. After that, the development pf resource sector employs and utilize number of labors in order to extract natural resources and convert them in to final goods. Another important way is that research and development sector develop novel technology in line with the current economic operations. In the end, environmental protection organizations levy taxes to manage environmental pollution stemming from businesses or manufacturing industry that utilize resources to produce goods.

3.1. Main model

(1) Manufacturing sector: By employing capital and labor, manufacturing industry utilizes resources from the resource development industry for creating new goods. Following equation represents the manufacturing sector's production function:

X= (TlsL) δ Gr £C1- δ-£ (1)

Where the overall amount of the end product is denoted by Y; C and Gr stands for the inputs of capital and resource-based goods utilized in the manufacturing sector for the production of final goods. T represents the level of technology utilized in the manufacturing sector. L shows a number of workers and ls represents the share of labor working in the manufacturing sector. £ (0< £<1) represents the elasticity and it shows the changes of resources-based goods due to change in the final outputs. δ (0 < δ<1) shows the amount of goods produced by the labor in manufacturing sector changes when the amount of labor changes.

(2) Resource development sector: The development of resource industry is responsible of extracting various natural resources and transforming these resources into the production of final goods. The production function for resource development sector can be represented in a following way, as suggested by Boyce and Emery (2011):

TO= ỌTldrLDr (2)

The Letter TO represents the amount of goods and services produced within the development of resource industry.in the development of resource industry, ldr is the

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share of labor. Dr stands for the utilization of natural resources which indicates the dependence on natural resources. A higher Dr (Dr>0) value indicates a higher dependence on resources. Because of the limited availability of advanced technology in the development of resource sector, this study utilized a parameter denoted by Ô (0<Ô<1) to show the lack of advancement in the technology in the development of resource sector.

3) Environmental protection sector: The manufacturing industry utilizes multiple natural resources to produce goods and the excessive utilization of these resources can lead to increase environmental degradation and pollution. Setting up the environmental policies in order to protect the environment and minimizing the emissions of harmful pollutants are crucial ways for enhancing the economy. Thus, the present study includes the protection of environment sector to examine whether environmental policies help in breaking the issue of resource curse. Following equation represent the particular function:

QE=QEoD- λ$λ (3)

The function of quality of environment (QE) is affected by three main factors including quality of environment at initial level (QEo), strictness of environmental policies ($) and resource utilization (RU). $ shows the costs for polluting the environment, indicating shows the stringency of the environmental policies. λ (λ>0) shows elasticity, indicates how much environmental protection industry change its output in response to environmental policies. In other words, it exemplifies the implementation of policies regarding the protection of environment. In case when the value of λ falls between 0 and 1, stringent environment polices results in lesser improvement in the quality of environment. This implies that at this time current policies regarding the environmental are ineffective. In case if the value of λ is greater than 1, when the environmental policies become more stringent the impact of improving the quality of environment become more significant and greater. As value of λ, the policies about protecting about the environment have greater on making the environment quality better. $D^{-\lambda}$ indicates that resource utilization has less detrimental impact on the environment compared to earlier times.

MN= ∀R (4)

T= $MN (5)

EM is when manufacturing sector releases toxic substances into the atmosphere during the production processes utilizing products from natural resources. ∀ indicates the level of pollution emitted from the utilization of specific per unit goods produced from natural resources represents the total amount of money collected as fees and taxes for polluting the environment through the release of pollutants.

(4) R&D sector**:** In the economy R&D plays a crucial role and is of greater significance to the manufacturing sector. It assists in advancement of technology, driving progress and generating new ideas. Most importantly, R & D sector help both the resource and development sectors with the technological support. The production function for R & D sector can be represented as

Mt= £ (1-lm-ln) LMt (6)

Where, capital of modern technology is denoted by Mt; 1-lm-ln represents the amount of labor invested in R&D sector. This sector's efficiency in transforming R & D investment into modern technology is denoted by £ (£>0).

5) Households. The households' endeavors to maximize their long-term happiness within their budget constraints. This is achieved by utilizing specific function referred to as "constant relative risk aversion (CRRA)" as follows:

$U(c) = max \int_0^{\infty} \frac{C^{1-\forall}-1}{1-\forall} e^{\surd} dt$ (7)

$CA = TO - TC$ (8)

Where, Overall consumption of household is denoted by CA. $\forall(\forall \geq 0)$ represents the intertemporal substitution of consumption elasticity. A higher number implies a less likelihood of change in the family spending's. $\surd(\surd > 0)$ refers to the subjective rate of discount.CA represents the accumulation of capital, encompassing both consumption (TC) and overall output (TO). Utilizing the condition mentioned earlier, Hamilton function determines the most optimum level and help in determining the consumption's rate of growth.

$GRc = \frac{c}{c} = \frac{r-\surd}{\forall}$ (9)

3.2. Analysis of Equilibrium

At steady state level, equilibrium condition involves ensuring that consumers' satisfaction is maximized, companies are maximizing profit and clearance of market in all sectors of the economy including R & D, manufacturing and development of resource sectors. Initially this study develops a model consisting of different three sectors without accounting for the sector for protection of environment. After that, this study constructed model with inclusion of another sector for environmental protection. Therefore, the article's main objective is to see whether environmental policies can address the issues associated with the resource curse. This study also put forward some hypothesis that this research aims to verify.

(1) Without considering the environmental protection sector: If the environmental protection sector is not considered, the development of resource sector maximizes its profit by adjusting the utilization of natural resources as well labor. The production function can be represented as follows:

$\boldsymbol{\pi}_{Res} = \text{maxim}[\{1 - \bar{o})PR_{Res}\,\text{R} - Wag_{Res}\text{nL}$ (10)

Where W_R is utilized to represent the wage in the development of resource sector; P_R stands for the prices of goods made from the resources. The manufacturing sector generally tries to generates its maximum amount of profit through modifying its input especially resource-based goods, capital as well as labor. The basic model for manufacturing sector can be represented in a following way:

$\boldsymbol{\pi}_{Y} = \text{maxim}[\{\text{Y-}Wag_{Y}mL - rC - PR_{res}R)$ (11)

The connection between dependence on resources and economic growth can be found by taking first partial derivative of rate of economic growth w.r.t the dependence on resources.

$\frac{dEG_Y}{dDR} = \frac{-\delta lm^{\delta}\ (\mu ln)^{£}\, D^{£-1}ב^{-\alpha-£/(1-\delta-£)}}{\forall} < 0$ (12)

According to equation 12, when countries heavily dependent on natural resources, they usually experience slower economic growth in case of absence of environmental protection sector. This indicates that relying excessively on the natural resources can result in curse rate of economic growth.

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(2) Including the environmental protection sector: In a pleasant environment with an abundance of natural resources, workers put extra effort and work more diligently and increase their productivity. As a result, this contributes to enhanced productivity within the development of resource sector. In contrast, in case when the environmental conditions are not very pleasant or good, there is less availability of natural resources and workers become less efficient and productive, leading to decline in the resource development sector's output. Thus, when we included the environmental protection sector, we look at impact of quality of environment on the activities and projects in the development of resource sector. The production function can be represented in a following way:

$$R = \mu TlnLDE \qquad (13)$$

By modifying resource-based goods and labor inputs the manufacturing sector increases its profit until it maximizes its profit at highest level while in case of development of resource sector, the maximization of profit function is same as previously observed. At the same time, fees and taxes for the protection of environment are required to pay from the manufacturing sector that corresponds to their emission levels. The model for maximization of profit can be represented in the following way:

$$\pi_Y = \text{maxim}[\text{Y-}Wag_Y lmL - PR_{res}R - rC - T) \qquad (14)$$

When we took differentiation of rate of economic growth w.r.t dependence on resources, we get

$$\frac{dEG_Y}{dDR} = \frac{\delta(\lambda-1)lm^{\delta}\,(\mu lnQEo\$^{\lambda})^{£}D^{(1-\lambda)£-1}ɔ^{(-\delta-£)/(1-\delta-£)}}{\forall} \qquad (15)$$

Equation 15 shows that, when the ν changes, the direction of first partial derivate of rate of economic growth w.r.t to dependence on resource also changes. If the value of λ is greater than 1, this indicates that stringent environment policies have a positive and greater impact on the quality of environment. Additionally, countries that highly depend on their natural resources often experience a higher rate of economic growth, referred to as resource blessing. If the value of λ is less than 1, then the effectiveness of stringent environmental policies in enhancing the quality of environment decreases. Greater dependence on the resources is adversely related to the rate of economic growth, which is referred to as resource curse.at this stage, environmental policies can assist in alleviating the issue of resource curse. To put it simply, in the early stages, environmental policies are not particularly stringent, implying that businesses have very little incentives to develop innovative approaches for conserving energy and reducing pollution. Hence if environmental policies are ineffective in significantly enhancing the quality of environment and therefore cannot help in alleviating the issue of resource curse. However, when the policies regarding the environment become more stringent, businesses utilizing natural resources are forced to minimize their consumption. It also prompts manufacturing businesses to discover innovative approaches for producing goods without heavily relying on natural resources. Ultimately, environmental policies work best towards enhancing the quality of environment and preventing further deterioration. In other words, it implies that environmental policies assist in alleviating the issue of resource curse. Therefore, the present study proposes and aims to verify the first hypothesis that is

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Hypothesis 1: At a particular level, Environmental policy stringency help in breaking the issue associated with resource curse.

3.3. Analysis of transmission mechanism

In the subsequent discussion, this study discusses about three different transmission mechanism or ways through which environmental policies can assist in alleviating the resource curse problem.

Firstly, this study discusses about manufacturing development effect through which environmental policies can assist in alleviating the resource curse problem. The swift expansion of resource-based businesses may lead to crowd out investments in human capital and material capital within the manufacturing industries. This can result in various problems including poor value-added goods, slow production, pollution, lower productivity, ultimately impeding the regional economic growth as well as development of manufacturing sector. Environmental policies can address the issues regarding management and utilization of resources and assist in shifting of materials and labors from resource development to manufacturing businesses. In this manner, it can assist in alleviating the adverse consequences of resource mining projects or pursuits and accelerates the manufacturing processes. The manufacturing sector's development contributes to the improvement of whole economy as well as society to improve while also assists in breaking the resource curse issue.

Next this study talks about green technological innovation effect through which environmental policies can assist in alleviating the resource curse issue. Environmental policies can ultimately assist companies find more innovation solutions, potentially offsetting the expenses of these policies implementation. Moreover, these environmental policies can also increase efficiency, dive production and foster the overall development of the economy. Countries having lots of resources may find it challenging to manufacture goods and create novel technological innovations. However, the implementation of environmental protection policies can promote the development of innovative technology that use of sustainable practices. Environmental policies usually compel business that use abundance of natural resources and produce different goods to adopt novel technologies for promoting environmental sustainability. This may entail making mining activities safer, upgrading equipment as well as enhancing manufacturing processes. The goal is to utilize resources effectively and minimize reliance on resources. As a result, it assists in reducing the adverse consequences of depending excessively on resources and utilizing green technology as well as breaking the issue of resource curse. Additionally, policies pertaining to environment also play a crucial role in promoting the efficient usage of resources, improving the structure of factor endowment, and incentivize manufacturing and resource-based businesses to shift from conventional polluting industries to greener environmentally friendly ones, which assist alleviate the problem of resource curse.

Now this study discusses the resource dependence effect through which environmental policies can help in mitigating the resource curse problem. The enforcement of environmental policies significantly impacts the manufacturing as well as the development of resource sector. For one thing, outdated technology is

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utilized in the development of resource industry contributing to low value goods and inefficient production. This leads to issues such as environmental degradation, ecological damage during the processes of extraction of natural resources. Implementing environmental policies often lead to higher mining costs, ultimately deterring businesses from depletion of natural resources. Simultaneously, environmental policies compel many mining businesses to leave the market. This also reduces the reliance of development of resource sector on natural resources and seeds up the shift of resources and workers from the business that use natural resources Additionally, conventional manufacturing sectors utilize an abundance of resources in order to produce large quantities of products, resulting in environmental pollution as well as depletion of resources. The implementation of environmental policies also motivates businesses to minimize their consumption of resources and transition to sources of clean energy including wind and solar power instead of harmful sources of energy such as oil and coal. Therefore, environmental policies may assist in lessening the reliance of manufacturing sectors on the resource-based commodities. To put simply, this implies that more stringent environmental policies lead to reduced dependence and usage of natural resources. Following hypothesis have been proposed by this research in light of the discussion above

Hypothesis 2: Implementing environmental policies assist in in alleviating the resource curse by promoting development of manufacturing sector.

Hypothesis 3: Implementing environmental policies assist in in alleviating the resource curse by minimizing reliance on resources.

Hypothesis 4: Implementing environmental policies assist in in alleviating the resource curse by promoting novel innovations in green technology.

4.Empirical Framework, Methodology and Variables' Description

The first step in our research is to investigate how environmental policy stringency influences the phenomena of the resource curse. The present study set environmental policy stringency as the main dependent variable and resource curse as independent variable. Subsequently, by utilizing two-step system GMM, researchers conduct empirical tests on resource curse regions and all the samples. In dynamic panel data models, the GMM estimator utilizes diverse methods or data estimation and incorporates both level and differenced equations, thus addressing the issue such as bias and endogeneity and missing variables. The choice of the two-step GMM estimators in this study is based on its greater effectiveness in empirical testing as opposed to one step system GMM. Additionally, the literature review suggests that there is non-linear connection between environmental policy stringency and coefficient of resource curse. Thus, this study incorporates the square of environmental policy stringency into the model and utilizes a following panel dynamic model for this study:

$$\mathrm{REC}_{it} = \alpha_1 + \alpha_2 EPSI_{it} + \alpha_3 \mathrm{EPSI}_{it}^2 + \alpha_4 \mathrm{CON}_{\mathrm{it}} + \alpha_5 REC_{1.t-1} + \delta_{it} + \mu_{it} + \acute{\varepsilon}_{it} \quad (16)$$

Where, a particular country is represented by the subscript "i", and a particular time is denoted by the subscript "t". CON comprises of set of control variables which includes including REC 1-year lagged, physical capital, human capital, green

technological innovation, resource dependence, manufacturing development, industrial structure and government intervention . The symbol μ denotes the country fixed effects, which captures the country's time invariant traits and $\boldsymbol{\delta}$ represents the fixed effects for each year, and ε represents the error term. Moreover, this study investigates the relationship between environmental policy stringency, green technology, and reliance on resources within the particular model to understand their role in breaking the resource curse. The structure of the model is set up in the following way:

$$\mathrm{REC}_{it} = \alpha_1 + \alpha_2 EPSI_{it} + \alpha_3 \mathrm{EPSI}_{it}^2 + \alpha_4 \mathrm{EPSI}_{\mathrm{it}} * \mathrm{M}_{it} + \alpha_5 \mathrm{M}_{\mathrm{it}} + \alpha_6 \mathrm{CON}_{\mathrm{it}} + \alpha_7 REC_{1.t-1} + \delta_{\ t} + \mu_t + \acute{\varepsilon}_{\ it} \qquad (17)$$

4.1 Dependent variable:

The resource curse was taken as core dependent variable. The resource curse coefficient reflects the degree to which economic growth influenced by the presence of ambulance of natural resources (Kinnaman, 2023).A higher coefficient indicates a more significant impact of the more resource curse, whereas lower coefficient indicates a less detrimental resource curse for the city. Studies have suggested the existence of the resource curse in certain countries, but have not fully elucidated its impact on the top 10 green economies, however, different countries experience varying degrees of the resource curse due to differences in economic growth and available resources. Therefore, the provincial resource curse coefficient is not reliable and effective measure for assessing the resource curse level in various countries. Due to the lack of each country data, this study evaluates the resource curse in each country by comparing the output value of mining companies with the overall output value of all countries 'mining companies, and then comparing the output of industrial companies with the overall output of all countries 'industrial companies. The formula can be written as,

$$REC_{it} = \frac{\mathrm{MOV}_{it} \Big/ \sum_{n=1}^{10} \mathrm{MOV}it}{\mathrm{IOV}it \Big/ \sum_{n=1}^{10} \mathrm{IOV}it} \qquad (18)$$

Where REC_{it} stands for the resource curse coefficient of country i in year t; MOVit represents the overall manufacturing output of industrial factories in country i during year t; the IOTit represents the value of output of major mining corporations in country i during year t. Thus, the resource case coefficient quantifies the extent to which the abundances of natural resources can influence the economic growth of different countries. A coefficient resource curse greater than 1 for the country signifies a failure to profit from its resources and experiencing the negative effects of the resource curse. As the resource curse coefficient increases, the country will experience more severe resource curse problems If the resource curse number is less than 1,it mean there is no evidence of a resource curse.

Table 1 shows the green economies with the highest, lowest and no recourse curse coefficient.

Green economies	Recourse Curse coefficients	Recourse curse level
Sweden	0.0019	LRC
Denmark	0.0029	LRC
United Kingdom	0.0054	LRC
Finland	0.0000	NRC
Switzerland	0.0000	NRC
France	0.0103	LRC
Costa Rica	10.6341	HRC
Iceland	8.5332	HRC
Norway	7.7834	HRC
Ireland	6.4785	HRC

Note: LRC stands for green economies lowest recourse curse; HRC stands for green economies with highest resource curse; NRC refers to no resource curse
Table 1 provides information of top green countries with lowest, highest and no resource curse economies. Based on Table 4, there are four countries with highest resource curse coefficient and four countries with lowest coefficient of resource curse. Ireland, Iceland, Costa Rica, and Norway are the four economies with the higher coefficient of resource curse. These countries heavily depend on natural resources for manufacturing but their inefficient utilization.

4.2 Independent variable:
We evaluated the environmental policy stringency by considering different measures that comprise the "environmental policy stringency index" (EPSI). The EPSI encompass policies such as market-based policies (EPS1) that increase cost of pollution and non-market-based policies (EPS2) that establish specific restrictions on emissions. These two sub-indexes within the policy stringency index (EPS), each carrying equal weight. These measures are calculated utilizing a method suggest by the OECD (Bue, 2023). The range of EPS spans from 0 and 6.A score of 0 indicates that the policies are highly strict or stringent. The data for EPS was obtained from OECD database. This study utilized two main components of environmental policy stringency as suggested by the OECD to examine whether EPS assist in breaking the resource curse issue. As shown in Figure 1, each component of EPSI carries equal weight in shaping the EPSI rating.

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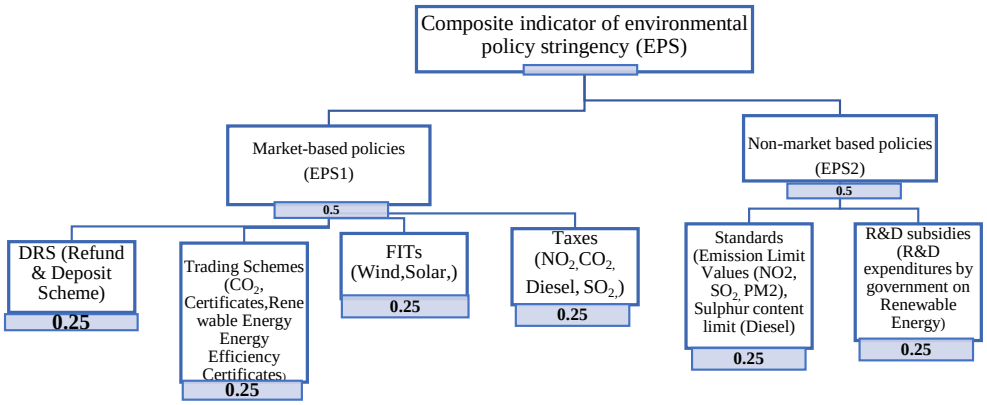

4.3 Control variable

This study also includes some control variables including natural resource rents, capital formation, 1-year lagged resource curse, foreign direct investment (FDI) and human capital (HC). Natural resource rents as a percentage of GDP were used as a proxy of natural resource rents. Another control interest variable used in this is the natural resources measured by the sum of five natural resources rents, including oil, natural gas, coal, minerals, and forestry rents, as a percentage of GDP. It comes from the World Bank development indicators. Real capital (RCAP) uses per capita used as proxy for Capital formation. FDI is another control variable utilized in the analysis. DI can benefit economies by the integration of novel technologies, financial investments and managerial expertise. This can contribute the diversification and expansion of the economies, leading to lower dependence on natural resources. Likewise, Shinwari et al., (2023) reported that FDI has the potential to increase the productivity of host economies and stimulate the growth of businesses, thus assists in alleviating the adverse consequences of resource curse. However, the effectiveness of FDI depends on the specific environmental policies in the economies where it occurs. Data for FDI is gathered from WDI. The study also includes resource dependence variable as control variable, which gauges the impact of mining companies on the total production of manufacturing companies. Based on Yang and song (2019), this article chooses the ratio of the manufacturing workers to the overall workers as a proxy for assessing the development of manufacturing sector (DM). Another control variable is “Green technology innovation” (IGT). Researchers commonly used patent information as a measure the level of innovations in novel technology (Du et al.,2109).The presence of green patents in a specific industry the level of innovations in ecofriendly being produced within a particular field .The quantity of patents is an indicator of the effectiveness of the novel technology, in contrast to the quantity of patents applied for (Wu et al., 2023).Therefore, using study conducted by Fusillo (2023)as a reference, this paper selects the green invention patents as a proxy variable to measure green technological innovations. This study also includes labor force total as proxy

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variable for human capital. Labour force. Labor force has been commonly utilized by numerous researchers (Mengesha and Singh, 2023; Baharin et al., 2020) as proxy variable to measure human capital.

4. Results and Discussion

This paper examines the connections between resource curse and environmental policy stringency (EPS) based on the earlier explained empirical framework and this study also aims to see that whether EPS can help top green economies in effectively utilize its resources, that is to check whether hypothesis 1 is approved or not. After that, this study determines whether EPS can mitigate the issue of resource curse by promoting manufacturing development, minimizing dependence on resources and accelerating the utilization of green technology that is to validate the hypothesis 2, hypothesis 3 and hypothesis 4.

Table 3 presented the initial results of the estimation for equation 16 for the selected samples and countries experiencing resource curse. In column, 2-5 of Table 4, EPS1 and EPS2 are utilized as proxy variable for environmental policy stringency (EPS). According to the results of AR test, the regression results are consistent, indicating the presence of serial auto correlation of first order (error terms are interrelated). The Sargan test is performed to verify the accuracy of the instruments and the null hypothesis states that there are not excessive number of instrumental variables. In all the regression, the results of Sargant test does not provide evidence of the rejection of null hypothesis, suggesting the effectiveness of chosen instrumental variable in this research. From Table 3, we can draw different significant conclusions. Firstly, according to the results based on regression, both non market based and market-based environmental policies have similar results. EPS has positive and significant impact on resource curse. In contrast, secondary coefficient shows the negative effect, implying that excessive environmental policies adversely affect the resource curse. These results indicate presence of inverted U connection between EPS and resource curse. Put simply, findings show that turning point exist when EPS mitigates the adverse effect of resource curse. If the environmental policies are not sufficiently strict, these policies are not effective in limiting the utilization of resource development-based actions. When environmental policies are less effective for safeguarding the environment, it poses challenges for some countries' economic development. Strict environmental policies tend to improve the quality of environment, particularly when these policies surpass the threshold turning level. Strict environmental policies also make harder for businesses that consume or heavily dependent on energy, fail to embrace and implement advanced technology and generate substantial level of pollution. This drives business to implement and upgrade superior technology, limiting the detrimental consequences of excessive usage of resources as well as supporting in promoting economic growth. In other words, it implies that environmental policies help in breaking the adverse consequences of resource curse. As we mentioned above, environment can be split down into policies based on market based and non-market based. In case if the proxy variable representing environmental policies is EPS1, the turning points of environmental policies in the entire group and in sample of resource curse countries are 3.470 and 4.702 respectively. On the other hand, when we used proxy

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variable representing environmental policies is EPS2, the turning points of environmental policies in the entire group or in the sample of resource countries are 0.0141 and 0. 0157.Thus, upon reaching a certain level, both non market and market based environmental policies are effective in addressing the problem of resource curse. The evidence also suggests that there exists a turning point; they can effectively start to alleviate the negative consequences of the resource curse, thus aligning the hypothesis 1 of this study.

Table 2: Environmental policy stringency' effects on issue of resource curse

Variables	Whole sample		Recourse curse countries	
	Column (1)	Column (2)	Column (3)	Column (4)
	EPS1	EPS2	EPS1	EPS2
EPS1	0.802*** (8.70)	379.549*** (30.80)	1.086*** (3.20)	390.790*** (11.08)
EPS2	−0.202*** (-8.59)	−13708.752*** (-21.15)	−0.120** (-2.07)	−13253.107*** (-6.60)
REC(1 year lagged)	0.560*** (97.60)	0.559** (120.30)	0.469*** (42.89)	0.651*** (54.14)
HC	24.066*** (12.59)	15.756*** (7.92)	49.680*** (11.19)	60.022*** (17.89)
RED	0.879*** (11.90)	1.389*** (12.69)	0.730*** (2.69)	1.719*** (11.89)
DM	−3.121*** (-16.09)	−3.079*** -15.07)	−8.070*** (-11.39)	−8.000*** (-21.30)
IGT	−0.309*** (-20.22)	−0.244*** (-5.90)	−0.712*** (-13.41)	−0.169*** (-4.79)
GTI	−2.602*** (-12.49)	−1.860*** (-7.67)	−4.769*** (-4.89)	−2.570*** (-5.50)
FDI	−0.289 (-0.89)	0.180 (0.70)	0.161 (0.12)	1.279 (1.19)
Constant	7.859*** (1.690)	2.951*** (0.500)	2.170* (1.671)	4.759*** (1.809)
AR(1)	0.0000	0.0000	0.0000	0.0000
AR(2)	0.3481	0.2821	0.6375	0.6857
Sargan	0.9725	1.0000	0.8888	1.0000
EPS turning point	3.470	0.0141	4.702	0.0157
No of Obs.	310	310		

Note: The parentheses contains the standard error for the variable. Sargan test shows the probability values for null hypothesis that there are no over identification of instruments. The probability values for AR (1) and AR (2) represent the first as well as second order autocorrelation for the equations at first differences. ***, **,* stands for significance level at 1%, 5%, and 10%.

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According to review of literature, environmental policies can help in minimizing the adverse consequences of resource curse through promoting manufacturing development, minimizing dependence on resources and accelerating the utilization of green technology. This study delves into the mechanism about how environmental policies can help to alleviate the problem of resource curse. To do this, we included term of interaction between "environmental policies and manufacturing development" (EPS*DM), the term of interaction between "environmental policies and green technology" (EPS*IGRT), the term of interaction between "environmental policies and dependence on resources" (EPS*DPR). These interaction terms are incorporated into the main model and then employs two-step GMM in order to test the hypothesis 2, hypothesis 3, hypothesis 4. Table 4 and Table 5 presented the findings of the regression analysis. The findings indicated that the results of both non market based and market based environmental policies are very similar to each other and from the results we can make following conclusions. Firstly, in all the countries included in the sample group and the countries afflicted by resource curse, the study's findings discovered that if country's overdependence on its resources has positive consequences whereas when we added terms of interaction between environmental policies and dependence on resources, we found that it has led to negative consequences. These research's results imply that environmental policies may indirectly assist top green economies lower its dependence on resources and help in mitigating the adverse consequences of the resource curse. The enforcement of environmental policies drives up the expenses for businesses for using to access the utilization of various resources. This ultimately hinders the companies' abilities to develop these resources and reduces the quantity of goods made from them, leading to reduced reliance on natural resources. Simultaneously, environmental policies often force businesses to switch from natural resource intensive businesses to those that do not rely on resource intensive businesses. This minimizes the crowding out effects of businesses-based resources on manufacturing sector and addresses the problem of resource curse.

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Table 3: Results of regression analysis on the transmission mechanism (using all available data or entire sample).

Variables	EPS1			EPS2		
	Column (1)	Column (2)	Column (3)	Column (4)	Column (5)	Column (6)
REC(1 year lagged)	0.669* (0.444)	0.090*** (0.038)	0.540** (0.192)	0.680* (0.650)	0.081** (0.033)	0.640** (0.099)
EPS	0.341*** (0.066)	−0.089*** (0.014)	−0.744*** (0.220)	1.650* (0.893)		
EPS*IGT	−0.020* (0.008)			−1.238* (0.880)		
IGT	−0.080* (0.050)			−0.009* (0.006)		
EPS*RED		−0.420*** (0.180)			−1.360*** (0.160)	
RED		1.589** (0.749)			1.736*** (0.329)	
EPS*DM			−0.949*** (-0.222)			−1.293*** (0.151)
DM			1.760** (0.670)			−1.190*** (0.237)
EPS2	−0.040* (0.027)	-0.019* (0.010)	-0.081* (0.069)	-1.120** (0.380)	-2.069*** (0.861)	−3.299*** (0.270)
IGT	−0.069* (0.049)	−0.129* (0.088)	−0.090*** (0.016)	−0.259* (0.130)	−0.089* (0.069)	−0.369*** (0.124)
HC	2.031*** (0.823)	1.190** (0.490)	1.740** (0.599)	2.708*** (0.658)	5.077*** (1.147)	8.963*** (2.883)
GTI	−0.720*** (0.089)	1.049*** (0.269)	−1.089* (0.808)	−1.504** (0.520)	1.244* (0.603)	−1.530* (0.97)
FDI	1.689** (0.990)	0.109* (0.080)	0.150 (0.149)	1.108* (0.799)	−0.006 (0.133)	−0.070 (0.181)
Constant	1.529*** (0.200)	1.580* (0.890)	5.130*** (1.397)	4.171*** (1.319)	0.851* (0.461)	6.023*** (3.550)
AR(1)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
AR(2)	0.3074	0.1891	0.2725	0.2764	0.3249	0.3240
Sargan	0.9032	0.6341	0.7429	0.6872	0.9785	1.0000
No of Obs.	310	310	310	310	310	310

Note: ***, **,* stands for significance level at 1%, 5%, and 10%. The parentheses contain the standar error for the variable. Sargan test shows the probability values for null hypothesis that there are no over identification of instruments. The probability values for AR (1) and AR (2) represent the first as well as second order autocorrelation for the equations at first differences.

Secondly, in all sample cases, non-market-based policies and market based environmental policies both can assist in alleviating the issue of resource curse through promoting more manufacturing activities. In contrast, countries suffering from resource curse, market-based policies and market based environmental policies are not effective in breaking the issue of resource curse through the

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development of manufacturing activities. Stringent environmental policies force many pollution causing and energy consuming companies to leave the marketplace. This also assists in enhancing several companies and decreases the potential for resource-based companies causing damage to the manufacturing. Therefore, it prevents the proliferation of adverse impact resulting from excessive consumption of resources from spreading. However, in countries plagued by the issue of resource curse, there is absence of strict policies regarding the environment and the manufacturing industries are not highly developed. In such resource curse areas, stringent environmental policies do not effectively support or positively affect manufacturing development, therefore these policies are ineffective in solving the issue of resource curse though the development of different manufacturing activities. Thirdly, in all the countries in the sample group and countries suffering from resource curse, the coefficient of use of green technology and the coefficient of term of interactions between environmental policies and use of green technology both have negative sign. These results indicate that resources, previously perceived as detrimental consequences on growth, may contribute positively to growth. Environmental policy stringency motivates businesses that release pollutants to adopt advanced technology in order to become more environmentally conscious or eco-friendly. This contributes to the development higher quality environmental goods, promotes the expansion of green sector, and compensates for the crowding out effects of development of resources on technological advancement. Therefore, implementing environmental policy stringency may indirectly help in alleviating the issue of resource curse in selected several green economies through promoting the utilization of green technology. Therefore, hypothesis 2, hypothesis 3 and hypothesis 4 have been proven accurate and valid.

5.Conclusion and Policy Implications

The study's main objective is to see whether environmental policy stringency serves as a catalyst for breaking the resource curse phenomena. Data of top ten green economies spanning from 1995 to 2015 is the focus of this article. Moreover, this study considers both market based and non-market based environmental policies and then evaluate their potential to see whether they assist in breaking the resource curse issue. Additionally, the present study seeks to explore multiple transmission mechanisms through which environmental policy stringency breaks the issue of resource curse. This paper offers empirical as well as theoretical support for the top ten green economies in their efforts to protect the environment, utilization of resources more effectively and alleviate the issue of resource curse. Moreover, the study's results have the potential to benefit green economies as well other countries dealing with significant natural resource related issues and assisting them in alleviating the problem associated with resource curse. The research uncovered several significant findings. Firstly, the phenomena of higher resource curse primarily observed in least green economies (Ireland, Norway, Iceland, Costa Rica), whereas lowest resource curse phenomena occur mainly in some top green economies (Sweden, Denmark, United Kingdom, France) and it is not prevalent in two economies including Switzerland and Finland. Secondly, this study also found that environmental policy stringency (Market based and non-market based

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environmental policies) and the issue of resource curse are connected in a way that looks like inverted U shape. Only when the environmental policies stringency passes the point of inflection can stringent environmental policies assist in alleviating the issue of resource curse. In other words, it implies that stringent policies for environment is critical in mitigating the adverse consequences of abundant natural resources. Thirdly, this paper uncovered that in full samples both market based and non-market based environmental policies can help to indirectly break the resource curse though accelerating the development of manufacturing, promoting the level of green technologies, minimizing the greater dependence on natural resources. However, the study found no concreate evidence to support the idea that the development of manufacturing effect of market based as well the non-market-based policies for environment have successfully alleviate the issue of resource curse has not been observed in the countries affected by the resource curse.

6.1 Policy implications

One point is to consider is the need for greater efforts in brainstorming the novel ideas to advance and speed up green technologies. Therefore, countries should improve technologies in order to obtain resources in a more effective manner. Additionally, these countries should manage the waste produced by mining activities in a manner that reduce the pollution and benefits the whole environment. In the meantime, manufacturing sector should enhance their abilities for developing strategies for minimizing consumption of energy and minimizing level of pollution. This may assist in protecting the environment and discovering the innovative approaches for achieving sustainable growth, ultimately contribute to long term economic growth while also ensuring the protection of the environment. Secondly, the government should strive to enhance the quality of environmental policy stringency (both market based and non-market based environmental policies). Then they should encourage people as well businesses to also assist protect the environment. This way, rather than causing the resource curse, this may increase the importance of natural resources and abundance of natural resource may become a resource blessing. Additionally, the governments' authorities in green economies should take critical steps to enhance efforts in improving and protecting the environment and establishing more rigorous environmental policies to achieve this goal. This action will contribute to the sustainable growth of the green economies in a manner that is beneficial for the environment. The government should enact stringent and stronger environmental policies for protection of the environment. Implementing this measure will have a beneficial effect on the overall environment as well as the whole green economies. Thirdly, it is necessary to reduce the economy's reliance on natural resources and utilization of natural resources and strives to innovate new sources of energy, all while also focusing on prioritization of environmental conservation. The government authorities should implement stringent environmental policies in order to safeguard the environment and continually enhance the tax system to deter the depletion of natural resources.

6.2 Research's Limitations

This study has some limitations. Firstly, one limitation of this research is its narrow focus on the environmental policy stringency while other important factors including population density, energy mix, economic structure, CO2 emissions and sources of energy also influence the consumption of resources and resource curse. Thus, future researchers should consider looking different approaches for evaluating environmental policy stringency.

References

Ahmad, M., Peng, T., Awan, A. and Ahmed, Z., 2023. Policy framework considering resource curse, renewable energy transition, and institutional issues: Fostering sustainable development and sustainable natural resource consumption practices. Resources Policy, 86, p.104173.

Ahmed, K., 2020. Environmental policy stringency, related technological change and emissions inventory in 20 OECD countries. Journal of environmental Management, 274, p.111209.

Akinbo, O.S., 2021. Natural Resource Curse, Economic Freedom, Economic Growth and Development: Case of Africa (Doctoral dissertation, Michigan Technological University).

Alssadek, M. and Benhin, J., 2023. Natural resource curse: A literature survey and comparative assessment of regional groupings of oil-rich countries. Resources Policy, 84, p.103741.

Anser, M.K., Yousaf, Z., Nassani, A.A., Vo, X.V. and Zaman, K., 2020. Evaluating 'natural resource curse'hypothesis under sustainable information technologies: A case study of Saudi Arabia. Resources Policy, 68, p.101699.

Arjomandi, A., Gholipour, H.F., Tajaddini, R. and Harvie, C., 2023. Environmental expenditure, policy stringency and green economic growth: evidence from OECD countries. Applied Economics, 55(8), pp.869-884.

Baafi, J.A., 2024. Unraveling Ghana's Resource Curse Hypothesis: Analyzing Natural Resources and Economic Growth with a Focus on Oil Exploration. Economies, 12(4), p.79.

Baharin, R., Syah Aji, R.H., Yussof, I. and Mohd Saukani, N., 2020. Impact of human resource investment on labor productivity in Indonesia. Iranian Journal of Management Studies, 13(1), pp.139-164.

Dai, S. and Du, X., 2023. Discovering the role of trade diversification, natural resources, and environmental policy stringency on ecological sustainability in the BRICST region. Resources Policy, 85, p.103868.

Du, K., Li, P. and Yan, Z., 2019. Do green technology innovations contribute to carbon dioxide emission reduction? Empirical evidence from patent data. Technological Forecasting and Social Change, 146, pp.297-303.

Feng, G., McLaren, K.R., Yang, O., Zhang, X. and Zhao, X., 2021. The impact of environmental policy stringency on industrial productivity growth: A semi-

parametric study of OECD countries. Energy Economics, 100, p.105320.
Feng, Y., Gao, Y., Xia, X., Shi, K., Zhang, C., Yang, L., Yang, L. and Cifuentes-Faura, J., 2024. Identifying the path choice of digital economy to crack the “resource curse" in China from the perspective of configuration. Resources Policy, 91, p.104912.
Frohm, E., D’Arcangelo, F.M., Kruse, T., Pisu, M. and Sila, U., 2023. Environmental policy stringency and CO2 emissions: Evidence from cross-country sector-level data.
Fusillo, F., 2023. Green Technologies and diversity in the knowledge search and output phases: Evidence from European Patents. Research Policy, 52(4), p.104727.
Guan, S., Liu, J., Liu, Y. and Du, M., 2022. The nonlinear influence of environmental regulation on the transformation and upgrading of industrial structure. International Journal of Environmental Research and Public Health, 19(14), p.8378.
Hayat, A. and Tahir, M., 2021. Natural resources volatility and economic growth: evidence from the resource-rich region. Journal of Risk and Financial Management, 14(2), p.84.
Imran, M., Alam, M.S., Jijian, Z., Ozturk, I., Wahab, S. and Doğan, M.,2024. From resource curse to green growth: Exploring the role of energy utilization and natural resource abundance in economic development. In Natural Resources Forum. Oxford, UK: Blackwell Publishing Ltd.
Inuwa, N., Adamu, S., Sani, M.B. and Modibbo, H.U., 2022. Natural resource and economic growth nexus in Nigeria: a disaggregated approach. Letters in Spatial and Resource Sciences, 15(1), pp.17-37.
Johnstone, N., Haščič, I., Poirier, J., Hemar, M. and Michel, C., 2012. Environmental policy stringency and technological innovation: evidence from survey data and patent counts. Applied Economics, 44(17), pp.2157-2170.
Khan, S.A.R., Ponce, P., Yu, Z. and Ponce, K., 2022. Investigating economic growth and natural resource dependence: An asymmetric approach in developed and developing economies. Resources Policy, 77, p.102672.
Kinnaman, T.C., 2023. A New Perspective on the Natural Resource Curse. World, 4(4), pp.670-683.
Kuang, H., Liang, Y., Zhao, W. and Cai, J., 2023. Impact of natural resources and technology on economic development and sustainable environment–Analysis of resources-energy-growth-environment linkages in BRICS. Resources Policy, 85, p.103865.
Lashitew, A. and Werker, E., 2020. Are natural resources a curse, a blessing, or a double-edged sword?.
Lashitew, A.A. and Werker, E., 2020. Do natural resources help or hinder development? Resource abundance, dependence, and the role of institutions. Resource and Energy Economics, 61, p.101183.
Lee, C.C., Zhong, Q., Wen, H. and Song, Q., 2023. Blessing or curse: How does sustainable development policy affect total factor productivity of energy-intensive enterprises?. Socio-Economic Planning Sciences, 89, p.101709.

Lee, T.C., Anser, M.K., Nassani, A.A., Haffar, M., Zaman, K. and Abro, M.M.Q., 2021. Managing natural resources through sustainable environmental actions: a cross-sectional study of 138 countries. Sustainability, 13(22), p.12475.

Lo Bue, E., 2023. How sustainability drives new venture investments: The moderating effect of upstream support policies (Master's thesis).

Luo, K., Wang, Q. and Liang, C., 2022. The way to break the resource curse: new evidence from China. Resources Policy, 79, p.102971.

Martínez-Zarzoso, I., Bengochea-Morancho, A. and Morales-Lage, R., 2019. Does environmental policy stringency foster innovation and productivity in OECD countries?. Energy Policy, 134, p.110982.

Mengesha, Z.D. and Singh, L., 2023. Human capital accumulation and economic growth of Ethiopian economy. African Journal of Science, Technology, Innovation and Development, 15(2), pp.211-226.

Miamo, C.W. and Achuo, E.D., 2022. Can the resource curse be avoided? An empirical examination of the nexus between crude oil price and economic growth. SN business & economics, 2, pp.1-23.

Miamo, C.W. and Achuo, E.D., 2022. Can the resource curse be avoided? An empirical examination of the nexus between crude oil price and economic growth. SN business & economics, 2, pp.1-23.

Mihai, D.M., Doran, M.D., Puiu, S., Doran, N.M., Jianu, E. and Cojocaru, T.M., 2023. Managing Environmental Policy Stringency to Ensure Sustainable Development in OECD Countries. Sustainability, 15(21), p.15427.

OECD, 2023. Connecting Ambition to Climate Policy Action: Highlights of OECD Work on Climate Change, 2023. [ONLINE]. Available at: https://www.oecd.org/stories/climate-change/en/infocus

Porter, M.E., 1991. Essay. Scientific American, 264(4), pp.168-168.

Qamruzzaman, M., 2024. Do natural resources bestow or curse the environmental sustainability in Cambodia? Nexus between clean energy, urbanization, and financial deepening, natural resources, and environmental sustainability. Energy Strategy Reviews, 53, p.101412.

Shah, Z., Zaman, K., Khan, H.U.R. and Rashid, A., 2022. The economic value of natural resources and its implications for Pakistan's economic growth. Commodities, 1(2), pp.65-97.

Shao, S. and Yang, L., 2014. Natural resource dependence, human capital accumulation, and economic growth: A combined explanation for the resource curse and the resource blessing. Energy Policy, 74, pp.632-642.

Sharma, C. and Mishra, R.K., 2022. On the good and bad of natural resource, corruption, and economic growth nexus. Environmental and Resource Economics, 82(4), pp.889-922.

Shinwari, R., Zakeria, I., Usman, M. and Sadiq, M., 2023. Revisiting the relationship between FDI, natural resources, and economic growth in Afghanistan: does political (in) stability matter?. Journal of the Knowledge Economy, pp.1-30.

Sun, Y. and Gao, J., 2023. Natural resource endowment and its lmpact on ecological efficiency. Resources Policy, 87, p.104272.

Taghizadeh-Hesary, F., Rasoulinezhad, E. and Yoshino, N., 2019. Energy and food security: Linkages through price volatility. Energy policy, 128, pp.796-806.

Tian, Y. and Feng, C., 2023. Breaking "resource curse" through green technological innovations: Evidence from 286 cities in China. Resources Policy, 85, p.103816.

Timilsina, G.R., Cao, J. and Ho, M., 2018. Carbon tax for achieving China's NDC: Simulations of some design features using A CGE model. Climate Change Economics, 9(03), p.1850006.

Wang, R., Tan, J. and Yao, S., 2021. Are natural resources a blessing or a curse for economic development? The importance of energy innovations. Resources Policy, 72, p.102042.

Wang, S., Wang, X. and Lu, B., 2022. Is resource abundance a curse for green economic growth? Evidence from developing countries. Resources Policy, 75, p.102533.

Wang, Y. and Chen, X., 2020. Natural resource endowment and ecological efficiency in China: Revisiting resource curse in the context of ecological efficiency. Resources Policy, 66, p.101610.

Wolde-Rufael, Y. and Mulat-Weldemeskel, E., 2021. Do environmental taxes and environmental stringency policies reduce CO2 emissions? Evidence from 7 emerging economies. Environmental Science and Pollution Research, 28(18), pp.22392-22408.

Wu, D., Jia, W. and Xie, Y., 2023. The impact of environmental information disclosure on green innovation in extractive enterprises: Promote or crowd out?. The Extractive Industries and Society, 14, p.101247.

Xiaoman, W., Majeed, A., Vasbieva, D.G., Yameogo, C.E.W. and Hussain, N., 2021. Natural resources abundance, economic globalization, and carbon emissions: Advancing sustainable development agenda. Sustainable development, 29(5), pp.1037-1048.

Yang, Q. and Song, D., 2019. How does environmental regulation break the resource curse: Theoretical and empirical study on China. Resources Policy, 64, p.101480.

Yirong, Q., 2022. Does environmental policy stringency reduce CO2 emissions? Evidence from high-polluted economies. Journal of Cleaner Production, 341, p.130648.

Zhang, D., Zheng, M., Feng, G.F. and Chang, C.P., 2022. Does an environmental policy bring to green innovation in renewable energy?. Renewable Energy, 195, pp.1113-1124.

Zhang, F., Wang, Q. and Li, R., 2024. Linking natural resource abundance and green growth: The role of energy transition. Resources Policy, 91, p.104898.

Zheng, R., Wu, G., Cheng, Y., Liu, H., Wang, Y. and Wang, X., 2023. How does digitalization drive carbon emissions? The inverted U-shaped effect in China. Environmental Impact Assessment Review, 102, p.107203.

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Symbols and description

Symbol	Description
REC	Coefficients of resource curse
EPS1	Market based environmental policies
EPS2	Non market based environmental policies
REC (1 year lagged)	1 year lagged resource curse
EPS	Environmental policy stringency
EPSI	Environmental policy stringency index
IGT	Innovations in green technology
GTI	Government Intervention
HC	Human capital
DM	Development of manufacturing