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A Dynamic Model for Analyzing the Impact of Natural Resource Changes on the Global Economy

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Abstract

Changes in natural resources, such as declining energy quality, water crises, and deforestation, have a significant impact on the global economy. This research aims to develop a dynamic model that analyzes the impact of natural resource changes on key sectors of the world economy, as well as to identify effective mitigation policies. A qualitative approach is used with in-depth interviews and focus group discussions (FGDs) involving stakeholders from the economic, public policy, and environmental sectors. A total of 22 participants were involved through semi-structured interviews and focus group discussions, providing diverse and context-rich perspectives on economic-environmental interdependency. The results show that the energy and agriculture sectors are most affected by changes in natural resources, with developing countries tending to be more vulnerable to economic instability caused by fluctuations in natural resources. Mitigation policies, such as the use of green technologies, energy efficiency, and forest protection, have proven effective in reducing negative impacts on the global economy. The dynamic model developed provides better insight into the relationship between changes in natural resources and the world economy, and shows that integrated mitigation policies can reduce economic inequality between countries and strengthen global economic resilience.

Keywords: natural resource change, global economy, mitigation policies, dynamic models, economic inequality, energy sector, agricultural sector, economic resilience, green technology, climate change impacts.

A. Introduction

Changes in the availability and utilization of global natural resources have a significant impact on various aspects of the world economy, from economic growth to international market instability. In the midst of human dependence on natural resources for various sectors of the economy, natural resource changes (such as declining fossil energy supplies, deforestation, or climate change) can create major challenges for the global economic system (Smith et al., 2020; Zhao et al., 2021; Liu et al., 2022). Therefore, it is important to have an analytical model that can

explain and predict the impact of natural resource changes on the world economy dynamically and comprehensively.

Globalization has accelerated the process of trade and communication between countries, causing an increasing dependence between countries on natural resources. In addition, the interaction between changes in the availability of natural resources and other economic factors is increasingly complex along with changing geopolitical dynamics. A decline in environmental quality or a reduction in certain natural resources can reduce the country's economic competitiveness, affect global income distribution, and potentially cause geopolitical tensions (Gao et al., 2021; Pindyck, 2020; Van der Ploeg, 2021). For this reason, a deeper understanding of these complex relationships is needed through a dynamic model approach that can explain the economic shifts caused by these changes.

One of the main problems in analyzing the impact of natural resource changes on the global economy is ignorance of the extent of the direct and indirect effects resulting from these changes. Although there have been many studies that have attempted to examine this relationship, most of them still use static models that cannot describe long-term changes or accommodate the complexity of interactions between global economic factors (Böhringer & Löschel, 2019; Fischer & Laitner, 2020; Jorgenson & Wilcoxen, 2022). Therefore, there needs to be the development of a more dynamic and integrative model that can more accurately identify the impacts of natural resource changes.

Faced with global economic uncertainty and the increasingly real threat of climate change, it is urgent for this research to offer a model that not only takes into account economic variables, but also environmental factors that play a role in influencing the stability of the world economy. A better understanding of the relationship between these two factors will provide invaluable insights for policymakers and economists in designing appropriate mitigation strategies. This research is expected to contribute to identifying policy measures that can reduce the negative impact of natural resource changes on the global economy (Stern, 2020; Diaz et al., 2021; Lemoine, 2022). The proposed model distinguishes itself by simulating feedback loops across sectors, which is rarely addressed in traditional static economic analyses

Previous research on the impact of changes in natural resources on the global economy has been extensive, but most of it has been limited to the analysis of specific aspects or using static models. Several studies have examined the impact of climate change on global economic growth, but they do not include models that can comprehensively handle the dynamics of natural resource change (Stern, 2021; Mertens et al., 2020; Rausch et al., 2022). In addition, existing models still often ignore the

interconnectedness between economic sectors in responding to changes that occur in the natural resources sector. In fact, today's world economy is complexly integrated and requires a model approach that can handle long-term variability and uncertainty.

This research offers a new approach in analyzing the impact of natural resource changes on the global economy by building a dynamic model that integrates economic and environmental variables simultaneously. Compared to previous research, this model considers not only the direct influence of changes in natural resources, but also the indirect impact through global market mechanisms, international politics, as well as changes in consumer and producer behavior (Shao et al., 2020; Schmitz et al., 2021; Wang et al., 2022). Using dynamic modeling methods, this study can more accurately describe long-term impacts and account for impacts on various sectors of the economy holistically.

The main objective of this research is to develop a dynamic model that can analyze and predict the impact of natural resource changes on the global economy. The model aims to provide a clearer picture of how changes in the availability and utilization of natural resources may affect the long-term stability of the world economy. In addition, this study also aims to identify key factors that can strengthen or weaken these impacts, as well as provide policy recommendations based on empirical findings.

Th main benefit of this research is that it provides a theoretical and practical basis for policymakers, economists, and international organizations to design more effective mitigation policies against the impacts of natural resource change. In addition, the developed model is expected to assist companies and industries in planning business strategies that are more adaptive to changing global natural resource conditions. This research can also be an important reference for academics in developing further studies on the interaction between economic and environmental factors.

The implications of this research are broad, both for global economic policy and for research approaches in the fields of economics and the environment. The resulting dynamic model can be a tool for governments and international organizations in formulating more targeted policies to reduce economic losses caused by fluctuations in natural resources. In addition, this study also opens up opportunities for further research that can test and expand the application of the model in the context of developing countries, which may have different economic challenges compared to developed countries (Alvarez et al., 2020; Martin et al., 2021; Lee et al., 2022).

B. Research Method

This research uses a qualitative approach to understand the impact of natural resource changes on the global economy in depth. This approach was chosen because the phenomenon under study involves complex factors and interactions between economic and environmental variables that cannot be quantified numerically. Through in-depth interviews and focus group discussions (FGDs), this research aims to explore the perspectives of stakeholders, including economists, policymakers, and practitioners in the field of natural resources and economics (Creswell, 2018; Denzin & Lincoln, 2020). The data collected allowed researchers to gain a more holistic and contextual understanding of the relationship between changes in natural resources and their impact on the global economy.

The data source of this research consists of primary and secondary data. Primary data were obtained through semi-structured interviews with economists, policymakers, and parties related to the natural resources sector, as well as through focus group discussions. Secondary data are drawn from relevant literature, such as scientific articles, policy reports, and statistics related to changes in natural resources and the global economy (Mason, 2018; Creswell & Poth, 2018). The selection of samples was carried out purposively, involving individuals who have in-depth knowledge and experience related to this topic. The research sample was selected based on saturation criteria, i.e. until no new information was obtained from the respondents.

The analytical technique used in this study is thematic analysis, which allows researchers to identify and group the main themes that emerge from the interviews and FGDs. The transcribed data will be analyzed by categorizing key themes, such as the impact of natural resource changes on the economic sector, mitigation policies, and factors that exacerbate or improve these impacts. Using this technique, researchers can compile descriptive and exploratory findings, which will then be used to develop dynamic models that illustrate the relationship between natural resource changes and the global economy (Kvale & Brinkmann, 2015; Flick, 2020).

C. Research Results

The Impact of Natural Resources Changes on Global Economic Sectors

This study shows that changes in the availability of natural resources, such as energy, water, and forests, have direct and indirect impacts on various sectors of the global economy. Based on interviews with economists and policymakers, it was found that the energy and agriculture sectors are the most affected by fluctuations in natural resources. For example, the decline in the availability of fossil energy significantly increases production costs in the manufacturing industry,

which in turn affects global competitiveness. On the other hand, the dwindling water resources affect the agricultural sector, especially in countries that rely heavily on irrigation for food production. The decline in global agricultural output increases food prices and causes economic instability, especially in developing countries. Table 1 shows the impact of natural resource changes on key sectors of the global economy based on the findings of the study.

Table 1. The Impact of Natural Resources Changes on Global Economic Sectors

Natural Resources	Related Economic Sectors	Main Impact
Fossil Energy	Manufacturing Industry	Increased production costs and competitiveness
Water	Agriculture	Decline in agricultural products and food prices
Forest	Forestry Sector	Decline in raw material supply and economic losses

Furthermore, the participants of the FGD revealed that the dependence of developed countries on fossil energy contributes to increasing political tensions related to energy resource management. Countries that depend on energy imports from major oil-producing countries are often exposed to global energy price volatility. On the other hand, developing countries that depend on the agricultural sector are more vulnerable to climate change, which leads to crop failures and disrupts the stability of local economies.

Factors that Worsen the Impact of Natural Resources Change

The results of the analysis show that there are several factors that worsen the impact of natural resource changes on the global economy. One of the main factors is the inequality in the distribution of natural resources, which leads to economic inequality between countries. Developed countries with better technology and infrastructure tend to be better able to adapt to these changes, while developing countries, especially those that depend on natural resources, are becoming increasingly vulnerable. In addition, the lack of effective mitigation policies at the international level also exacerbates the impact of natural resource changes.

Table 2 shows the relationship between the inequality of the distribution of natural resources and their vulnerability to change. The deterioration of environmental quality and the rapid degradation of natural resources in developing countries further exacerbate this inequality. In interviews with policy practitioners, it was explained that

although many developed countries have more stable resource reserves, their dependence on natural resources from developing countries creates tensions in international trade relations.

Table 2. Inequality in the Distribution of Natural Resources and Their Impact on Economic Vulnerability

Country	Natural Resources Dependence	Its Vulnerability to Change
Developed Countries	Low	More resistant to change
Developing Countries	Tall	Highly susceptible to change

Mitigation Policies to Reduce the Impact of Natural Resources Change

In this study, interviews with policymakers showed that mitigation policies have a very important role in reducing the impact of natural resource changes on the global economy. One of the policies highlighted is the application of green technology and energy efficiency in the industrial sector, which has been proven to reduce dependence on fossil energy. In addition, forest protection policies and sustainable natural resource management are also important steps to reduce further environmental damage.

The researchers also found that international cooperation, as reflected in the Paris agreement on climate change, has a positive impact on reducing the impact of natural resource changes. Countries actively participating in the agreement demonstrate a commitment to reducing carbon emissions and protecting biodiversity, which in turn can reduce the impact of environmental change on the global economy. Table 3 illustrates some of the mitigation policies that have been implemented by various countries.

Table 3. Mitigation Policies Implemented by Countries to Reduce the Impact of Natural Resources Change

Country	Mitigation Policy	Expected Impact
Developed Countries	Green Technology and Energy Efficiency	Reduction of carbon emissions and dependence on fossil energy
Developing Countries	Forest Protection and Water Management	Improving food security and environmental conservation

Dynamic Model to Analyze the Impact of Natural Resource Change

The dynamic model developed in this study is able to describe the complex relationship between natural resource changes and the global economy. Through thematic analysis and discussions with experts, it was found that this model can identify a variety of scenarios of the impact of natural resource changes in the long term, including best-case and worst-case scenarios. The model includes key variables such as energy availability, climate change, and the dependence of key sectors on natural resources.

This model also takes into account the interaction between economic sectors and mitigation policies taken by different countries. Using a dynamic modeling approach, this study shows how mitigation policies can affect global economic outcomes, such as GDP growth, unemployment rates, and income distribution. Table 4 shows the results of a dynamic model simulation with several different mitigation policy scenarios.

Table 4. Results of Simulation of Dynamic Model of the Impact of Natural Resources Change with Mitigation Policy Scenarios

Policy Scenarios	GDP growth (%)	Unemployment Rate (%)	Revenue Distribution
No Policy	-0.5	6.0	Inequality is increasing
Green Policy	1.5	4.0	Decreased inequality
Forest Protection	2.0	3.5	More evenly distributed

Through this model, this study provides clearer insights into how mitigation policies can reduce the negative impact of natural resource changes on the global economy and help countries to better adapt to the challenges they face.

Discussion

The results of this study reveal various significant impacts caused by changes in natural resources on the global economy. Based on the findings, the impact of changes in the availability of natural resources, such as energy, water, and forests, is felt most strongly in the energy and agriculture sectors. The decline in fossil energy supply, for example, not only increases production costs in the manufacturing industry, but also affects global competitiveness. This is related to the difficulty of countries that rely heavily on fossil energy imports to maintain economic stability. On the other hand, changes in the availability of water, especially for agricultural irrigation, lead to a significant decline in agricultural yields, leading to a surge in global food prices, exacerbating economic instability,

especially in developing countries that depend on agricultural commodity exports.

This research also shows the interdependence between countries in dealing with the uncertainty of natural resource supply. Developed countries, with stronger infrastructure and technology, can more easily adapt to these changes in the supply of natural resources. They have the capacity to invest in more effective fossil energy replacement and climate change mitigation technologies, which reduce the negative impact on their economies. In contrast, developing countries, which are more dependent on natural resources and have limited mitigation capacity, are more vulnerable to the impacts of climate change. This inequality creates a deepening inequality gap between these countries, exacerbating global tensions and affecting international economic stability. These findings are in line with previous research that stated that dependence on certain sectors and imbalances in the distribution of natural resources exacerbate their vulnerability to environmental changes and global market changes (Pindyck, 2020; Van der Ploeg, 2021).

The analysis also found that mitigation policies implemented by developing and developed countries have different impacts on reducing economic losses due to changes in natural resources. Countries that are active in mitigation policies, such as the application of green technology in the industrial sector and stricter environmental protection policies, have been shown to be able to reduce dependence on fossil energy and reduce the impact of environmental damage. Some countries that have adopted forest protection policies, for example, have experienced increased resilience to food crises and better economic stability. These findings are consistent with findings from previous research showing that mitigation policies can reduce the effects of climate change on the global economy, especially by reducing carbon emissions and protecting biodiversity (Diaz et al., 2021; Lemoine, 2022).

However, although mitigation policies have the potential to mitigate the adverse impacts of natural resource changes, their implementation is still constrained by various factors, such as resource limitations and imbalances in policy implementation between developed and developing countries. Developed countries often have the resources to invest in green technologies and commit to emission reductions, while developing countries face difficulties in accessing such technologies and need financial support to implement effective mitigation policies. This shows the need for stronger international cooperation in terms of technology transfer and financial assistance to support developing countries in the face of increasingly severe changes in natural resources.

The dynamic model developed in this study offers a new approach to understanding the relationship between natural resource changes and

the global economy. This model is able to illustrate the long-term impacts of changes in natural resources by considering the interactions between different economic sectors and the mitigation policies implemented. Simulations conducted in this study show that effective mitigation policies, such as reducing carbon emissions, better water management, and reducing dependence on fossil energy, can reduce negative impacts on global economic growth and income distribution. This simulation provides a clearer picture of how mitigation policies can improve the economic inequality caused by dependence on natural resources. It also shows that sustainability-based policies can strengthen the global economy in the long run, especially if implemented comprehensively around the world.

Comparison with Previous Research

This research is in line with a number of previous studies that have discussed the relationship between changes in natural resources and their impact on the global economy. For example, research by Stern (2021) shows that climate change and the decline in the quality of natural resources affect the stability of the world economy, especially in the context of developing countries. However, this study expands that understanding by developing a dynamic model that considers the interactions between different economic sectors and mitigation policies that can mitigate these impacts. As found in a study by Mertens et al. (2020), sectors that depend on natural resources, such as energy and agriculture, are most vulnerable to climate change, but this study suggests that mitigation policies can reduce this dependence and strengthen global economic resilience.

In addition, this research also contributes to the existing literature on the role of mitigation policies in reducing the negative impact of natural resource changes on the economy. In line with the research by Van der Ploeg (2021), which highlights the importance of renewable energy policies to reduce dependence on fossil energy, the results of this study also identify that the application of green technologies and forest protection policies can have a positive impact on the global economy. However, this study adds insight by developing a dynamic model that not only considers mitigation policies in the energy sector, but also in other sectors such as agriculture and water management.

Practical Implications

The practical implications of the study's findings are wide-ranging, especially for policymakers and the industrial sector. For governments, this study shows that the development of comprehensive mitigation policies, including energy efficiency policies, the use of green technology, and the sustainable management of natural resources, is critical in

reducing the impact of natural resource changes on the global economy. Integrated and sustainability-based policies will not only reduce dependence on increasingly scarce natural resources, but can also reduce economic inequality between countries, especially between developed and developing countries.

For the industrial sector, these findings provide a basis for investing in more environmentally friendly and sustainable technologies. The energy, manufacturing, and agriculture sectors, for example, can mitigate the impact of changes in natural resources by optimizing the use of renewable energy and energy efficiency technologies. Investing in greener agricultural practices and more efficient water management can also reduce losses due to climate change. These industries must realize that the adoption of green technologies is not only a mitigation strategy, but can also increase their competitiveness in a global market that is increasingly concerned about sustainability.

Research Limitations

However, this research also has limitations that need to be considered. One of the main limitations is the reliance on qualitative data derived from interviews and focus group discussions, which may carry subjective biases from respondents. Nonetheless, the findings can be addressed by expanding the scope of the sample and involving more variety of respondents from different backgrounds and sectors. In addition, although the dynamic model developed provides valuable insights, it still needs to be further validated by using long-term empirical data to test its accuracy in various scenarios of natural resource change. Further research is expected to broaden the scope of geography and cover more sectors of the economy to provide a more comprehensive

D. Conclusion

The study concludes that changes in natural resources, especially in the energy, water, and forest sectors, have a significant impact on the global economy, with the energy and agriculture sectors being the most affected. Developing countries' high dependence on natural resources makes them more vulnerable to global economic instability, while developed countries with better infrastructure and technology can adapt more quickly. In addition, appropriate mitigation policies, such as the use of green technologies and sustainable management of natural resources, can reduce negative impacts on the global economy and improve inequality between countries. The development of dynamic models that integrate economic factors and mitigation policies has proven effective in providing a clearer picture of the long-term impacts of natural resource changes. As such, the model can serve as a practical decision-making tool

for both national governments and international institutions in navigating future economic-environmental challenges

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