

MEDIATION OR MODERATION: ANALYZING THE ROLE OF ENVIRONMENTAL PROTECTION IN THE RELATIONSHIP BETWEEN ECONOMIC GROWTH AND SOCIETAL HAPPINESS

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Abstract

This study examines the relationship between economic growth, represented by Gross National Income (GNI), environmental protection, measured by the Environmental Performance Index (EPI), and societal happiness, assessed through the World Happiness Report (WHR). Analyzing data from 122 countries over two years (2020 and 2022), the findings reveal that EPI partially mediates, and does not moderate, the positive effect of GNI on societal happiness. While GNI significantly correlates with happiness, improved environmental performance enhances this relationship. The study highlights the need for distinct policies addressing economic growth and environmental sustainability to effectively promote societal well-being. The findings reveal that environmental protection serves as a partial mediator in the relationship between GNI and WHR. While GNI shows a significant positive correlation with happiness, the quality of environmental performance also plays a crucial role in enhancing this relationship, suggesting that higher EPI scores contribute positively to societal happiness.

Key words: economic growth, environmental protection, societal happiness, mediation, moderation.

INTRODUCTION

The relationship between economic growth, environmental protection, and societal happiness have been a subject of various research in the past. However, the findings do not always come to an agreement with one another. There is research that puts more emphasis on environmental protection and happiness even if it means slow economic growth (Sekulova & van den Bergh, 2013). On the contrary, there is also research arguing that all three of these elements are interconnected, and therefore, none of them could be sacrificed for the other two (Cloutier & Pfeiffer, 2015).

There is also research that focuses only on environmental protection and societal happiness only, thereby excluding the perspective of economic growth altogether. A research found that the relationship between happiness and pro-environmental behaviours is cyclical (Nguyen et al., 2024). This means that individuals with higher happiness are more inclined to engage in pro-environmental behaviours, which in turn can enhance societal happiness by fostering a healthier and more sustainable environment (Nguyen et al., 2024).

Similarly, another research highlighted that individual happiness is greater in natural environments, suggesting that preserving environments could contribute positively to societal happiness (MacKerron & Mourato, 2013).

Aside from economy, there is also research that associates the relationship between environmental protection and societal happiness with other aspects. A research found that environmental protection can play a significant role in enhancing happiness once it is coupled with social aspects such as family ties (MacKerron, 2011). On top of that, a research also argued that the aspect that can be correlated with environmental protection and societal happiness is social trust (Barrington-Leigh, 2017).

Regardless of what various past research has found in relation to environmental protection, the specific relationship between economic growth and happiness has been widely evidenced. A research found that economic growth and happiness is complex, suggesting that depending on income levels of the country, the relationship can be weak or strong (Zagórski et al., 2007). In poorer economies,

economic growth strongly correlates with happiness (Zagórski et al., 2007). In richer societies, however, the relationship is not as pronounced (Zagórski et al., 2007). This implies that there are factors that can influence this relationship. Given the extensive body of research on environmental protection side-by-side economic growth and happiness, it is reasonable to posit that environmental protection could be one of those factors.

This paper aims to investigate whether the role of environmental protection within the correlation between economic growth and societal happiness is moderating, fully mediating, or partially mediating. There are several ways how a third variable can impact the relationship between two variables of independent-dependent nature, which is moderation and mediation (Aguinis et al., 2017). Mediation itself can be further divided into two: full and partial (Aguinis et al., 2017). For moderation, it involves a variable that influences the strength or direction of the relationship between independent and dependent variables (Aguinis et al., 2017). For full mediation, it occurs when the effect of an independent variable on a dependent variable is entirely transmitted through a mediator (Aguinis et al., 2017). For partial mediation, it happens when the effect of an independent variable on a dependent variable is both direct (not mediated through a mediator) and indirect (mediated through a mediator) (Aguinis et al., 2017). In this case, the research question posed in this paper is: “Does environmental protection have moderating, fully mediating, or partially mediating effect on economic growth’s relationship with happiness?”



Figure 1. Full Mediation

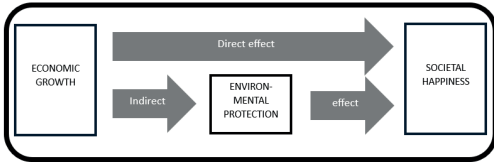


Figure 2. Partial Mediation

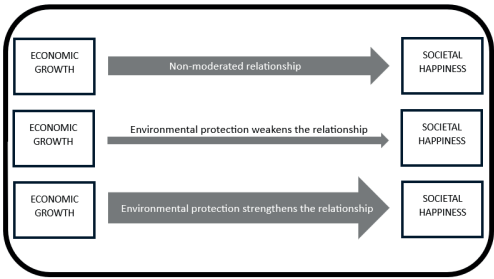


Figure 3. Moderation

MATERIALS AND METHODS

The three variables used in this paper are taken from various data sources. Economic growth is represented by the Gross National Income (GNI) that is taken from the World Bank (World Bank, 2024). The GNI data is PPP-adjusted (World Bank, 2024). Societal happiness is represented by the World Happiness Report (WHR) published jointly by Gallup, the Oxford Wellbeing Research Centre, the UN Sustainable Development Solutions Network, and the WHR’s Editorial Board (World Happiness Report, 2024). Meanwhile, environmental protection is represented by the Environmental Performance Index (EPI) from the Yale Center for Environmental Law and Policy (Yale EPI, 2024). The EPI itself is a bi-annual data-driven summary of the state of sustainability that works as a scoring system for countries based on climate change performance, environmental health, and ecosystem vitality (Yale EPI, 2024).

The data included in this paper encompasses 122 countries in 2 years, 2022 and 2020. The countries are: Albania, Algeria, Argentina, Armenia, Australia, Austria, Azerbaijan, Bahrain, Bangladesh, Belarus, Belgium, Benin, Bolivia, Bosnia and Herzegovina, Botswana, Brazil, Bulgaria, Burkina Faso, Cambodia, Cameroon, Canada, Chad, Chile, China, Colombia, Comoros, Costa Rica, Croatia, Cyprus, Czechia, Denmark, Dominican Republic, Ecuador, El Salvador, Estonia, Ethiopia, Finland, France, Gabon, Gambia, Georgia, Germany, Ghana, Greece, Guatemala, Guinea, Honduras, Hungary, Iceland, India, Indonesia, Iraq, Ireland, Israel, Italy, Jamaica, Japan, Jordan, Kazakhstan, Kenya, Kuwait, Latvia, Lesotho, Lithuania, Luxembourg,

Madagascar, Malawi, Malaysia, Mali, Malta, Mauritania, Mauritius, Mexico, Moldova, Mongolia, Montenegro, Morocco, Mozambique, Myanmar, Namibia, Nepal, Netherlands, New Zealand, Nicaragua, Niger, Nigeria, North Macedonia, Norway, Pakistan, Panama, Paraguay, Peru, Philippines, Poland, Portugal, Romania, Rwanda, Saudi Arabia, Senegal, Serbia, Sierra Leone, Singapore, Slovenia, South Africa, Spain, Sri Lanka, Sweden, Switzerland, Tajikistan, Tanzania, Thailand, Togo, Tunisia, Uganda, Ukraine, United Arab Emirates, United Kingdom, United States, Uruguay, Uzbekistan, Zambia, and Zimbabwe.

The type of analysis done in this paper is statistical in nature. The analysis is done in R software. The steps of analysis are:

1. Simple linear regression of the original model (referred to as Model 1) to check the effect of GNI to WHR. The formula is as follows:

$$Model_1 = GNI \rightarrow WHR$$

Here, the estimate and the standard deviation of the GNI's coefficient is taken, as well as R^2 and P-value of Model 1,

1. Mediation analysis is done by using the following sub-steps:

- a. Simple linear regression of the mediation model (referred to as Model 2) to check the effect of GNI to EPI. The formula is as follows:

$$Model_2 = GNI \rightarrow EPI$$

- b. Like Model 1, here the estimate and the standard deviation of the GNI's coefficient is taken, as well as R^2 and P-value of Model 2,

- c. Multiple linear regression of the combined model (referred to as Model 3) to check the combined effect of both GNI and EPI as independent predictors of WHR. The formula is as follows:

$$Model_3 = GNI + EPI \rightarrow WHR$$

Here, the estimate and the standard deviation for each of the predictors'

coefficients are taken, and so are the R^2 and P-value of Model 3,

- d. Calculation of indirect effect by multiplying the GNI's coefficient estimate of Model 2 and EPI's coefficient estimate of Model 3,
- e. Sobel test to determine the Z-value and P-value of indirect effect by using the following formulas:
- f. Z-value

$$z = \frac{a \cdot b}{\sqrt{b^2 \cdot SE_a^2 + a^2 \cdot SE_b^2}}$$

where

a = estimate of GNI's coefficient from Model 2

b = estimate of EPI's coefficient from Model 3

SE_a = standard deviation of GNI's coefficient from Model 2

SE_b = standard deviation of EPI's coefficient from Model 3

- g. P-value

$$p = 2 \times (1 - pnorm(|z|))$$

where

$pnorm$ is an R function that calculates the cumulative distribution

function (CDF) for the standard normal distribution. It returns the

probability that a standard normal random variable is less than or

equal to the given value (in this case, z).

2. Moderation analysis using the built-in function in R's multiple linear regression of the moderation model (referred to as Model 4) as follows:

$$moderation = GNI * EPI \rightarrow WHR$$

This basically shows multiple regression analysis with 3 independent variables, which are GNI (independent prediction of GNI to WHR), EPI (independent prediction of EPI to WHR), and GNI:EPI (prediction of interaction term between GNI and EPI to WHR). The P-value of all three will be taken,

3. Determination of the significance by checking if all P-values in the analysis are less than 0.05.

RESULTS AND DISCUSSIONS

Below is the data used in this paper:

Table 1. Data used in this paper

| Year | | GNI | WHR | EPI |
|------|------|---------|-------|------|
| 2020 | Max | 86,640 | 7.809 | 82.5 |
| | Min | 1,230 | 3.299 | 25.1 |
| | Mean | 23,031 | 5.625 | 49.7 |
| 2022 | Max | 118,470 | 7.821 | 77.9 |
| | Min | 1,210 | 2.995 | 18.9 |
| | Mean | 28,083 | 5.649 | 44.4 |

Below are the results:

Table 2. Results of regression analysis

| Year | Models | | | Variables | Coefficient | | |
|------|---------|----------------|-----------|-----------|-------------|--------------------|-----------|
| | Name | R ² | P-Value | | Estimate | Standard Deviation | P-Value |
| 2020 | Model 1 | 0.6215 | 2.200e-16 | GNI | 4.074e-05 | 2.902e-06 | 2.000e-16 |
| | Model 2 | 0.7561 | 2.200e-16 | GNI | 6.795e-04 | 3.524e-05 | 2.000e-16 |
| | Model 3 | 0.6743 | 2.200e-16 | GNI | 1.983e-05 | 5.473e-06 | 0.00043 |
| | | | | EPI | 3.076e-02 | 7.004e-03 | 2.450e-05 |
| | Model 4 | 0.6766 | 2.200e-16 | GNI | 3.150e-05 | 1.384e-05 | 0.02460 |
| | | | | EPI | 3.433e-02 | 8.014e-03 | 3.770e-05 |
| | | | | GNI: EPI | -1.882e-07 | 2.050e-07 | 0.3604 |
| 2022 | Model 1 | 0.63930 | 2.200e-16 | GNI | 3.286e-05 | 2.253e-06 | 2.000e-16 |

| | | | | | | | |
|--|---------|---------|-----------|----------|------------|-----------|-----------|
| | Mode 12 | 0.57700 | 2.200e-16 | GNI | 3.844e-04 | 3.005e-05 | 2.000e-16 |
| | Mode 13 | 0.65920 | 2.200e-16 | GNI | 2.608e-05 | 3.381e-06 | 4.150e-12 |
| | | | | EPI | 1.762e-02 | 6.681e-03 | 0.00946 |
| | Mode 14 | 0.66220 | 2.200e-16 | GNI | 3.690e-05 | 1.104e-05 | 0.00111 |
| | | | | EPI | 2.366e-02 | 8.890e-03 | 0.00886 |
| | | | | GNI: EPI | -2.112e-07 | 2.051e-07 | 0.30525 |

Table 3. Results of indirect effect calculation and sobel test analysis

| Year | Indirect Effect | Sobel Test | |
|------|-----------------|------------|-------------|
| | | Z-Value | P-Value |
| 2020 | 0.00000677 | 2.583004 | 0.009794409 |
| 2022 | 0.00002089 | 4.282109 | 0.000018513 |

The results of this study provide compelling evidence for the role of EPI in the relationship between GNI and WHR. The analysis across two years (2020 and 2022) reveals that while a significant relationship exists, it demonstrates partial mediation rather than full mediation nor moderation.

1. Presence of mediation

The results indicate that mediation is present due to the significant improvement in the R² value from Model 1 (original model, GNI → WHR) to Model 3 (combined model, GNI + EPI → WHR). Specifically, the partial mediation is evidenced by the change in the GNI coefficient between these models. In Model 1, GNI has a direct positive effect on WHR (positive coefficient estimate of 4.074e-05 and P-value < 0.05), signifying that increases in economic growth correlate with enhanced societal happiness. When EPI is introduced in Model 3, the coefficient estimate for GNI decreases (to 1.983e-05) while maintaining statistical significance (p < 0.05). This suggests that part of the effect of GNI on

WHR is transmitted through EPI, supporting the idea that improvements in environmental performance contribute to societal happiness and therefore partially mediate the economic growth-happiness relationship.

While the GNI coefficient estimate lowers yet remains statistically significant from Model 1 to Model 3, the increase in R² from Model 1 to Model 3 shows that mediation occurs because Model 3 can explain happiness better than Model 1. This improvement in explanatory power underscores the role of EPI in enhancing the understanding of how GNI influences WHR.

2. Evidence of partial mediation

The results support partial mediation rather than full mediation due to the continued significant direct effect of GNI on WHR. If EPI were a full mediator, the inclusion of EPI in Model 3 would nullify the direct effect of GNI on WHR, resulting in a non-significant GNI coefficient in that model. However, since GNI remains statistically significant in Model 3, it confirms that while EPI explains some of the variance in happiness, a direct path from GNI to WHR still exists, validating the notion of partial mediation.

Partial mediation can be clearly observed through the significance of both GNI and EPI coefficients in Model 3. For full mediation to occur, we would expect the EPI coefficient to remain significant while the GNI coefficient would lose its significance, which is not the case in our findings.

Furthermore, the calculation of the indirect effect, corroborated by the sobel test, shows a significant indirect effect ($p < 0.05$), which provides robust evidence for the mediating role of EPI. This significance of the indirect effect confirms the presence of partial mediation, as it indicates that the pathway from GNI to WHR through EPI is not only statistically relevant but also substantial. This finding effectively nullifies the possibility of full mediation, where one would expect the indirect effect to dominate entirely over the direct effect.

3. The direct and indirect effects

The analysis demonstrates that both the direct and indirect effects of GNI on WHR are statistically significant. The direct effect of GNI, as indicated in Model 1, shows a

significant positive coefficient ($p < 0.05$), confirming that higher economic growth correlates directly with increased societal happiness.

Simultaneously, the sobel test results confirm that the indirect effect through EPI is also significant, with a P-value indicating robust mediation ($p < 0.05$). This significance reinforces the conclusion that environmental protection plays a vital role in enhancing societal happiness indirectly.

Furthermore, a comparison of the coefficients from Models 1 and 3 reveals that both the direct path (GNI to WHR) and the indirect path (GNI to WHR via EPI) retain their significance without one overpowering the other. The coefficients suggest that while the direct effect remains strong, the indirect effect is substantial enough to warrant attention, thereby confirming the presence of partial mediation. This interplay between the direct and indirect effects highlights the complexity of the relationship between economic growth, environmental performance, and societal happiness.

4. The lack of moderation

The lack of moderation is evident from the analysis of the interaction term (GNI: EPI) included in Model 4. The coefficient for the interaction term is not statistically significant ($p = 0.3604$), indicating that EPI does not influence the strength or direction of the relationship between GNI and WHR. This finding suggests that while environmental protection is related to societal happiness, it does not act as a conditional factor that alters the impact of economic growth on happiness. Consequently, we cannot assert that environmental performance modifies the effect of GNI on happiness, reinforcing the notion that the relationship is more direct than conditional.

5. The R² increase from model 1 to model 3 and model 1 to model 4

Despite the high R² values and significant p-values across all models, the increase in R-squared from Model 1 to Model 3 and from Model 1 to Model 4 does not indicate that moderation occurs. The improvement in R-squared when introducing EPI into the GNI-to-

WHR relationship signifies that EPI accounts for additional variance in happiness beyond what is explained by GNI alone. This enhancement supports the idea that environmental performance plays a critical role in influencing societal happiness.

However, the absence of a statistically significant interaction term (GNI: EPI) in Model 4 indicates that EPI does not modify the effect of GNI on WHR. While the inclusion of EPI improves the model's explanatory power, it does so by acting as a mediator rather than a moderator. Therefore, the observed increases in R² values illustrate the importance of considering environmental protection in understanding the relationship between economic growth and happiness, but they do not support the notion that moderation is present in the data.

These results ultimately illustrate that while environmental protection plays a role in mediating the relationship between economic growth and societal happiness, it does so partially and does not exhibit moderating effects. The significance of the indirect effect, as indicated by the Sobel test, further substantiates the notion of partial mediation and rules out full mediation. Future research could explore additional mediating variables or different methodologies to further elucidate the complexities of these relationships and refine our understanding of how economic, environmental, and societal factors interplay in influencing happiness.

6. Policy recommendations

The findings of this study highlight the critical role of environmental protection as a mediator in the relationship between economic growth and societal happiness. This mediation suggests that targeting economic growth and environmental protection separately, while acknowledging the influence of economic growth on environmental quality, is essential for enhancing overall happiness.

Governments should implement policies that stimulate economic growth through infrastructure investments and innovation support, directly correlating with societal happiness. Concurrently, stringent environmental regulations are necessary to improve environmental performance and,

subsequently, happiness. Advancing renewable energy and sustainable practices as distinct initiatives further supports this goal.

Moreover, educational programs promoting economic skills and environmental awareness can prepare individuals to contribute meaningfully to both sectors. Policymakers should use separate data sets for each sector to inform strategies, ensuring targeted interventions. Public awareness campaigns that highlight the benefits of both economic growth and environmental health can also foster support for happiness.

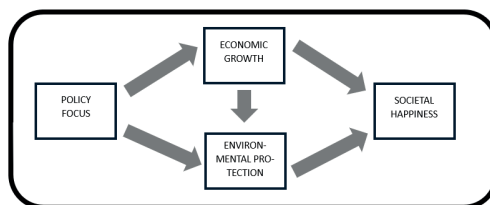


Figure 4. Recommended Policy Focus

In contrast, the lack of moderation role of environmental protections in economic growth's influence on happiness observed in this study indicates that merging economic growth strategies with environmental protections may lead to conflicting objectives and undermine effectiveness. Thus, combined policies should be avoided, as it would only detract from sustainability efforts and do not provide any added benefit to the positive impacts of economic growth on happiness.

In summary, effective policies should focus independently on economic growth and environmental protection while recognizing their interrelationship. By implementing these recommendations and steering clear of combined approaches, governments can create a framework that aligns with the study's findings, ultimately enhancing societal happiness.

CONCLUSIONS

This study investigates the interplay between economic growth, represented by Gross National Income (GNI), environmental protection, measured by the Environmental Performance Index (EPI), and societal happiness, assessed through the World

Happiness Report (WHR). The findings reveal that environmental protection serves as a partial mediator in the relationship between GNI and WHR. While GNI shows a significant positive correlation with happiness, the quality of environmental performance also plays a crucial role in enhancing this relationship, suggesting that higher EPI scores contribute positively to societal happiness.

Importantly, the analysis finds no evidence that EPI moderates the relationship between GNI and WHR. This indicates that policymakers should adopt distinct strategies for promoting economic growth and environmental sustainability, acknowledging their interdependence without conflating the two concepts. By implementing policies that separately address GNI growth and improvements in EPI, governments can foster a more effective approach to enhancing overall societal happiness. Future research should continue to explore the complexities of these relationships to further elucidate the dynamics at play.

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