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Green Economy Transition in Vietnam: Assessing Unemployment and Life Expectancy Dynamics

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ABSTRACT

The study assesses how the environmental factor influences the social dimension of the global green economy index. Covering the period from 1991 to 2023, the study utilizes a descriptive-quantitative approach with time-series data. It employs the Ordinary Least Squares (OLS) model in EViews to examine the connections between these variables and socioeconomic results. The findings reveal that CO2 emissions negatively affect life expectancy, while forest area contributes positively. Nevertheless, the use of renewable energy does not demonstrate a statistically significant impact on life expectancy. Similarly, none of the independent variables—CO2 emissions, forest area, and renewable energy consumption—were statistically significant for unemployment. The autoregressive term (AR(1)) is highly significant, indicating that past unemployment rates strongly influence current unemployment levels. These results emphasize the importance of addressing environmental factors to improve life expectancy, while also highlighting the limited direct impact of green economy variables on unemployment in Vietnam.

INTRODUCTION

Green growth signifies an economic advancement that prioritizes environmental sustainability, low-carbon practices, and societal inclusivity. It encompasses planning a path to economic success and welfare while reducing resource consumption and emissions in areas such as agriculture, transportation, construction, real estate, and energy. Green growth acts as the groundwork for developing a green economy, defined by a rise in investments in initiatives that utilize natural resources and lessen environmental risks, including renewable energy, low-carbon transportation, energy and water efficient structures, sustainable farming, forestry management, and fishing practices. A way to measure the progress of countries on global sustainability is through the Green Economy Index. This study will use the Green Economy Index introduced by the National Development Planning Agency of Indonesia. There are three aspects of the green economy index: environmental, social, and economic. The social aspect of the index includes unemployment and life expectancy. Drean (2022) and Jiang (2022) examine how the green economy relates to life expectancy, with Drean observing a temporary decline in life expectancy associated with economic growth, while Jiang highlights the beneficial impact of green technology on life expectancy in specific nations. Manea & Cozea (2022) underscores the potential of the green economy to address environmental and economic challenges, including the improvement of population health and well-being. Among the developing countries, Vietnam is one of the countries actively making efforts to transition to a green economy.

Currently, the unemployment rate in Vietnam ranges from 1.6 - 2.4 percent (MacroTrends, 2024), which is relatively low compared to many other countries. The global unemployment rate as of 2023 was at 5.12 percent (O'Neill, 2024), higher than Vietnam's. For the life expectancy at birth in

Vietnam, there is an increasing trend from 69.85 years in 1991 to 75.77 years in 2023 (World Bank, n.d.). The life expectancy in Vietnam is higher as compared to the world life expectancy ranging from 72 - 73 years (MacroTrends, 2024).

This study aims to close the existing gap in the literature by analyzing the effects of CO^2 emissions, renewable energy consumption, and forest area on unemployment and life expectancy in Vietnam. The objective is to provide insights for policies that foster economic development and enhance overall well-being. The research aims to analyze and quantify the relationship of CO2, renewable energy consumption, and forest area to unemployment and life expectancy in Vietnam. The study will cover the selected environmental aspect of the green economy index of Vietnam and its impact on the selected social aspect of the index. The scope includes the examination of three key independent variables: CO2 emissions, renewable energy consumption, and forest area, and their correlation with the two dependent variables which is the unemployment and life expectancy with 33 observations using time-series data. The analysis of the variables will be conducted on a national level, encompassing diverse sectors and regions within Vietnam.

The significance of this study lies in the intricate correlation between environmental factors and its influence on the social dimensions of the green economy. By uncovering the impacts of renewable energy consumption, CO2 emissions, and forest cover on unemployment and life expectancy, this study can offer valuable insights to inform policymakers, urban planners, and environmental advocates concerning the potential social implications of green economy initiatives. Furthermore, by identifying the causal relationships among these variables, the study can aid in formulating targeted interventions and policy frameworks aimed at advancing both environmental sustainability and social equity. Ultimately, this research has the potential to significantly influence decision-making processes at various measures local, national, and international.

MATERIALS AND METHODS

The research design used in this study is quantitative in nature wherein it analyzes and investigates the statistical relationship between the environmental indicators to the social indicators of the green economy index. The Green Economy Index shows potential for analyzing green economy development and progress towards sustainable development goals (Rybalkin, 2022). This research design is used in almost all studies that investigate the green economy index, similar to the study of Wang et al. (2023), which is quantitative in nature, using an analysis of panel data covering 121 countries and regions over the period from 2002 to 2018 to determine the relationship of CO2 and Renewable Energy on Life Expectancy. The researchers will use EViews software as their primary statistical tools to perform the following tests: unit root test (Augmented Dickey-Fuller Test), unrestricted cointegration rank test (trace), autocorrelation test (Breusch-Godfrey Serial Correlation LM Test), and heteroskedasticity test (ARCH). Uǧurlu (2019) and Tang (2016) provide an introduction to methods for analyzing time series data, particularly focusing on cointegration and unit root tests using EViews software. Niyimbanira (2013) offers an overview of methods for testing short- and long-run equilibrium, including unit root tests (Dickey-Fuller and Augmented Dickey-Fuller), cointegration tests (Durbin-Watson, Engle-Granger, and Augmented Engle-Granger), and error correction mechanisms. Studies have found long-term relationships between green economy variables using Autoregressive Distributed Lag (ARDL) techniques (Idris et al., 2023). The statistical analysis for this study is the Ordinary Least Squares (OLS) method, as it offers reliable and accurate estimates of the relationships between dependent and independent variables. OLS regression analysis in London revealed positive correlations between green spaces and well-being and life expectancy while noting a negative correlation with unemployment rates (Wang & Yuan, 2024). Houssam et al. (2023) also utilized Ordinary Least Squares (OLS) to investigate the role of the green economy across 60 developing countries, finding positive relationships with unemployment, but a negative relationship with poverty rates.

The researchers will be using the Grossman healthcare model to estimate the variables. The Grossman healthcare model provides a framework for understanding how various factors influence health decisions and outcomes (Bayati et al., 2013). Life expectancy is a key indicator in this model, reflecting both economic well-being and overall health (Chang, 2023). In the previously mentioned study by Wang et al. (2023), the model used is as follows:

$$LE = (RE, PGDP, HE, IS, UR, C)$$

This equation shows the functional relationship between life expectancy (LE) and various factors, including renewable energy sources (RE), per capita gross domestic product (PGDP), health expenditure (HE), industrialization (IS), urbanization (UR), and CO2 emissions (C). The researchers will utilize this equation as the foundation for analyzing the life expectancy variable. The transformed econometric equation is as follows:

$$LE = \beta_0 - \beta_1 CO2 + \beta_2 REC + \beta_3 FC + \epsilon$$

The dependent variable of life expectancy (LE) is retained as well as the independent variable CO2 emissions (CO2). Alongside that are the variables renewable energy consumption (REC), and forest cover (FC). Environmental factors, including CO2 emissions and forest cover, also play a role in determining life expectancy, with varying effects observed in developed and developing countries (Chen et al., 2021; Li et al., 2023).

For the unemployment rate, the researchers will be using the hybrid four variables regression model by Saboori et al. (2022):

$$UE_{it} = \mu_i + aRE_{it} + \beta NE_{it} + \gamma RG_{it} + \varepsilon_{it}$$

Where UE is the unemployment rate, RE is renewable energy consumption, NE is non-renewable energy consumption, and RG is real GDP. The transformed econometric equation is as follows:

$$UE = \beta_0 - \beta_1 CO2 + \beta_2 REC + \beta_3 FC + \epsilon$$

The unemployment rate (UE) and renewable energy consumption (REC) are kept, complying with the positive relationship results of the study by Saboori et al. (2022). The other independent variables are CO2 emissions (CO2), predicting a negative relationship, and forest cover (FC) predicting a positive relationship with the unemployment rate.

RESULTS AND DISCUSSION

Table 1 presents the descriptive statistics for CO2 emissions, forest area, life expectancy, and renewable energy consumption from 1991 to 2023. The descriptive statistics show that CO2 emissions have a wide range, as indicated by the large standard deviation, while variables like life expectancy have a smaller standard deviation. Jarque-Bera tests indicate no significant deviations from normality in all variables.

Table 1. Descriptive Statistics

Variable	Mean	Median	Maximum	Minimum	Std. Dev	Skewness	Kurtosis	Jarque-Bera p-value
CO_2 Emissions (kiloton)	139,159.2	105,137.0	355,323.0	19.797	108,319.6	0.748	2.275	0.150
Forest Area (% of land)	40.27	41.29	47.10	29.55	5.56	-0.497	1.984	0.249
Life Expectancy (years)	73.03	73.41	75.77	69.85	1.44	-0.426	3.030	0.607
Renewable Energy (%)	43.96	41.90	75.46	19.00	17.47	0.161	1.891	0.400
Unemployment (rate)	1.94	1.99	2.87	1.00	0.45	-0.481	3.012	0.530

Before conducting the Ordinary Least Squares (OLS) method, the stationarity of the variables is examined using the Augmented Dickey-Fuller (ADF) test.

Table 2. ADF

Augmented Dickey-Fuller test statistic		
	Prob.*	1st Diff. Prob.*
Co2_Emissions	0.4889	0.0054
Forest_Area	0.9830	0.0003
Renewable_Energy_Consump	0.0707	0.0025
Life_Expectancy	0.2576	0.0012
Unemployment_Rate	0.4767	0.0000

Table 2 shows the results of the Augmented Dickey-Fuller (ADF) test, which reveals the existence of unit roots in the time series data for all variables: CO2 emissions, forest area, renewable energy consumption, life expectancy, and unemployment rate. Similarly, the variables all have a p-value below 0.01 at the first difference. These results suggest that while the original time series data for these variables may not be stationary, differencing them leads to stationary series, which is crucial for valid econometric analysis.

Table 3. Unrestricted Cointegration Rank Test (Trace)

Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.632625	78.93725	69.81889	0.0078
At most 1 *	0.555108	47.89470	47.85613	0.0496
At most 2	0.316077	22.78706	29.79707	0.2567
At most 3	0.286514	11.00987	15.49471	0.2109
At most 4	0.017412	0.544519	3.841466	0.4606

The unrestricted cointegration rank test (trace) as shown in Table 3 was also employed to determine the presence of long-term equilibrium relationships among the variables under investigation. The results indicate the existence of two cointegrating equations at the 5% significance level. A high Trace statistic of 78.93725, significantly exceeding the critical value of 69.81889, further supports this conclusion. Along with that, the eigenvalue of 0.632625 indicates a moderately strong cointegrating relationship between the variables.

These results suggest that there are at least two long-run equilibrium relationships among the variables in the model, namely CO_2 emissions, forest area, life expectancy, renewable energy consumption, and unemployment. This verifies that, although there may be short-term changes, the factors generally align over the long term, indicating consistent relationships over time.

Table 4. OLS of DV1 - Unemployment Rate

Dependent Variable: Unemployment				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant	6.031782	4.357681	1.384115	0.1781
CO2_Emissions	-1.74E-06	3.24E-06	-0.536682	0.5961
Forest_Area	-0.069015	0.077480	-0.890750	0.3812
Renewable_Energy_Consump	-0.024358	0.030070	-0.809063	0.4258
AR (1)	0.664201	0.151226	4.392109	0.0002

R-squared	0.496504	Mean dependent var	1.914194
Adjusted R-squared	0.419043	S.D. dependent var	0.460313
S.E. of regression	0.350853	Akaike info criterion	0.908561
Sum squared resid	3.200540	Schwarz criterion	1.139849
Log-likelihood	-9.082694	Hannan-Quinn criter.	0.983955
F-statistic	6.409728	Durbin-Watson stat	2.041096
Prob(F-statistic)	0.000996		
Inverted AR Roots	0.66		

Table 4 shows the OLS results for unemployment, indicating that none of the independent variables—CO2 emissions, forest area, and renewable energy consumption—are statistically significant, as evidenced by their p-values of 0.5961, 0.3812, and 0.4258, respectively. These results suggest that changes in environmental factors do not significantly affect unemployment. Liu and Feng (2022), indicate that there is no causal link between unemployment and CO_2 emissions in the Asia-Pacific and Middle East regions. Similarly, Khobai et al. (2020) observed an insignificant short-term relationship between renewable energy consumption and unemployment in South Africa. The lack of significance in these environmental variables indicates that unemployment may be influenced more by economic or policy-related factors rather than environmental variables like forest area and renewable energy consumption. This indicates that these factors do not appear to impact unemployment within this model. The R-squared value of 0.4965 suggests that the model accounts for approximately 49.7% of the variation in unemployment. However, the autoregressive term (AR(1)) is statistically significant (p = 0.0002), indicating that past unemployment rates play a significant role in determining current unemployment levels. The Durbin-Watson statistic for the unemployment model is 2.041, which is close to the ideal value of 2. This indicates that there is no significant autocorrelation in the residuals.

Table 5. OLS of DV2 - Life Expectancy

Dependent Variable: Life Expectancy				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant	78.34961	0.830558	94.33373	0.0000
Co2 Emissions	-5.92E-06	2.07E-06	-2.853060	0.0084
D_Forest Area	0.122837	0.206410	0.595109	0.5569
Renewable Energy Consump	-0.105222	0.012862	-8.181051	0.0000
R-squared	0.903319	Mean dependent var		72.96003
Adjusted R-squared	0.892164	S.D. dependent var		1.203489
S.E. of regression	0.395207	Akaike info criterion		1.104749
Sum squared resid	4.060893	Schwarz criterion		1.291578
Log-likelihood	-12.57124	Hannan-Quinn criter.		1.164517
F-statistic	80.97554	Durbin-Watson stat		1.762279
Prob(F-statistic)	0.000000			

Table 5 shows the OLS results for Life Expectancy wherein CO_2 Emissions exert a statistically significant negative impact on life expectancy, with a p-value of 0.0084. Forest Area at first difference, while displaying a positive coefficient, is not statistically significant, with a p-value of 0.5569. Renewable Energy Consumption has a negative and significant effect on life expectancy, as demonstrated by a p-value of 0.000. The R-squared value of 0.9033 indicates that the independent variables included in the model can explain approximately 90.33% of the variance in life expectancy. Lastly, the Durbin-Watson statistic is 1.762, which is slightly below 2 but still within an acceptable range, suggesting a mild positive autocorrelation.

Table 6. Normality Test (Jarque-Bera)

Normality Test				
Life Expectancy	Jarque-Bera	3.117074	Probability	0.210444
Unemployment Rate	Jarque-Bera	1.464561	Probability	0.480811

Table 7. Autocorrelation Test (Breusch-Godfrey)

Breusch-Godfrey Serial Correlation LM Test:				
Life Expectancy	Prob. F(1,26)	0.9967	Prob. Chi-Square(1)	0.9964
Unemployment Rate	Prob. F(2,24)	0.8104	Prob. Chi-Square(2)	0.7640

Table 8. Heteroskedasticity Test (ARCH)

Heteroskedasticity Test: ARCH				
Life Expectancy	Prob. F(1,27)	0.0388	Prob. Chi-Square(1)	0.0378
Unemployment Rate	Prob. F(1,28)	0.9958	Prob. Chi-Square(1)	0.9956

From the Jarque-Bera Normality Test in Table 6, since the p-value of life expectancy is 0.21, and the p-value of the unemployment rate is 0.48, which are greater than 0.01 alpha, there is no non-normality. The Breusch-Godfrey Serial Correlation LM Test, presented in Table 7, demonstrates the absence of serial correlation in the residuals, being above 0.01 alpha with p-values of 0.9964 for life expectancy and 0.7640 for the unemployment rate. Similarly, the Heteroskedasticity Test (ARCH), presented in Table 8, indicates that there are no significant ARCH errors in the residuals, with p-values of 0.0378. for life expectancy and 0.9956 for the unemployment rate. These diagnostic results confirm that both models are normality distributed and are free from autocorrelation and heteroskedasticity, affirming the robustness and reliability of the regression outputs.

The negative impact of CO_2 emissions on life expectancy is consistent with the findings of Mahalik et al. (2022) and Ebhota et al. (2023), both of which demonstrate that higher CO_2 levels are linked to a reduction in life expectancy due to the harmful health impacts of environmental pollution and fossil fuel combustion. Alavijeh et al. (2023) confirmed this in G7 countries, showing that CO_2 emissions lower life expectancy across all percentiles, a trend also observed in developing regions like Nigeria, where carbon emissions contribute to a 0.35% decrease in life expectancy (Osabohien et al., 2020). Renewable energy consumption also showed a significant negative effect on life expectancy which aligns in the study of Wang et al. (2023) where they found that in less wealthy countries, initial increases in renewable energy consumption were negatively linked to life expectancy due to transitional challenges. Conversely, Pugliese et al. (2015) found that changes in forest management did not significantly improve socioeconomic factors like employment or population well-being, which could indirectly affect health and life expectancy. This suggests that forest cover alone has a limited direct impact on life expectancy, with broader structural factors likely playing a more influential role which is in line with the results.

Regarding unemployment, the study's results align with previous research showing that environmental factors like CO_2 emissions, renewable energy consumption, and forest cover do not significantly affect unemployment in Vietnam. Liu and Feng (2022) similarly found no significant relationship between CO_2 emissions and unemployment in the Asia-Pacific and Middle East regions, pointing to the greater importance of economic and structural factors. Khobai et al. (2020) also found no short-term link between renewable energy consumption and unemployment in South Africa, suggesting that the impact of renewable energy on labor markets may take longer to materialize or depend on specific circumstances. Pugliese et al. (2015) also found no significant link between forest cover and unemployment in Italy, noting that while forest areas can bring economic benefits through sectors like forestry and eco-tourism, local factors such as industrialization and urbanization are more influential on employment rates. Additionally, the study highlights the importance of past unemployment trends, as indicated by the significant autoregressive term, which aligns with Bu et al. (2022), who emphasize the path-dependent nature of employment trends and the role of historical patterns in shaping current outcomes under environmental regulations.

CONCLUSION

This research examined the influence of CO_2 emissions, forest coverage, and the use of renewable energy on unemployment and life expectancy in Vietnam. The results indicated that CO_2 emissions, forest coverage, and renewable energy use have a negative effect on unemployment rates in Vietnam; however, these effects lack statistical significance. On the other hand, as the autoregressive term is positively significant, a notable portion (66.42%) of the current period's unemployment rate can be explained by the previous period's data. Furthermore, CO_2 emissions adversely affect life expectancy, whereas forest coverage is positively associated with it. Although renewable energy consumption displayed a negative relationship, this was not statistically significant. Despite the unclear direct effects, renewable energy could provide indirect advantages by lessening CO_2 emissions over time. Policymakers should concentrate on lowering CO_2 emissions, protecting forest areas, and enhancing renewable energy infrastructure. Emphasizing sustainable practices and enforcing stricter emission standards can improve public health, environmental conditions, and economic development. Future studies should explore long-term effects using advanced econometric methods to yield more comprehensive insights. These results offer important lessons for sustainable development strategies in Vietnam and other developing nations.

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