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CO_2 Emissions and Subjective Well-Being: Empirical Evidence from The Southeast Asian Population

Moh. Wahyudi Priyanto[1], Dian Eswin Wijayanti[1], Yahya Shafiyuddin Hilmi[2,3]
[1]Department of Agribusiness, Universitas Trunojoyo Madura, Bangkalan, Indonesia
[2]Department of Social Agricultural Economics, Universitas Gadjah Mada, Sleman, Indonesia
[3]Doctoral School of Economics and Regional Science, Hungarian University of Agriculture and Life Sciences, Gödöllő, Hungary
Corresponding Author: wahyudi.priyanto@trunojoyo.ac.id

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Abstract

An increasing amount of carbon dioxide (CO_2) affects the planet and people. As a primary contributor to climate change, CO_2 has been a subject of discussion among researchers. Many have been studying the complex relationship and impact of CO_2. However, a study examining the influence of increased CO_2 emissions on human subjective well-being is limited. This study aims to fill the gap by utilizing a sample of 9,724 Southeast Asians from the Seventh World Values Survey (2017-2021). Well-being is measured using a subjective approach, such as happiness and life satisfaction. The ordered probit regression analysis indicates that increased per capita CO_2 emissions decrease happiness and life satisfaction. Additionally, the higher individuals' financial and health levels, the higher their relationship with their happiness and life satisfaction will be. This study encourages further research investigating a specific country's relationship between CO_2 emissions and the well-being of its population.

Keywords: CO_2 emission; subjective well-being; Southeast Asia; happiness; satisfaction
JEL classification: I31; O13; P48; Q56; R1

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1. Introduction

ASEAN aims to enhance the well-being and livelihoods of its people by providing equitable access to opportunities for human development, social well-being, and justice (ASEAN, 2008). The well-being of the community has declined due to the COVID-19 pandemic. Many households have experienced hunger and a heightened likelihood of severe poverty in the post-pandemic period. well-being indicators, such as income, have decreased and are strongly correlated with the COVID-19 pandemic. Communities in lockdown areas, such as those in Indonesia, Laos, the Philippines, and Vietnam, face an increased risk of

income decline and rising expenditures (Morgan & Trinh, 2021). Furthermore, poverty indicators are also alarming. Approximately 150 million more people worldwide will experience extreme poverty by 2020, a 20% increase from pre-pandemic levels (Laborde et al., 2020). The United Nations (UN) has stated that the pandemic has driven 44 million people into extreme poverty by 2030, and this number is likely to rise to one billion (Ferdous, 2021). Additionally, population growth has been shown to have a negative impact on poverty (Ahlburg, 1996).

One of the measures of societal well-being is income level, where Indonesia's per capita income in 2020 declined by 6.43% compared to 2019 (Worldbank, 2021). Moreover, well-being can be measured through a subjective approach using the concepts of happiness and life satisfaction. The underlying principle of this notion is that well-being individuals should be happy and have high life satisfaction (Nugroho et al., 2022; Rahman et al., 2022). Happiness is defined as an internal sensation of a positive state of mind. Meanwhile, life satisfaction is interpreted as the quality of life based on personal standards (Brailovskaia et al., 2022). Human well-being is vulnerable to disease, conflict, and natural disasters, while economic systems that support well-being are vulnerable to globalization, currency speculation, and crises of trust. Many aspects of vulnerability are related to low security and well-being, as well as unsustainable resource use (Adger & Winkels, 2018). Environmental aspects are currently widely discussed due to their presumed impact on well-being. For instance, air pollution has been found to cause economic losses by deteriorating health and the quality of human resources (Sarmiento, 2022), ultimately reducing well-being. Greenhouse gas emissions, particularly nitrogen dioxide, are known to have a negative correlation with well-being due to their detrimental effects on human health (Welsch, 2002). Furthermore, climate change resulting from greenhouse gas emissions increases psychological stress and decreases well-being (Thomas et al., 2014).

Since the onset of the industrial revolution in 1750, there has been a sharp increase in greenhouse gas emissions (GHG) due to fossil fuel consumption, economic activities, energy, coal mining, and agriculture (Mohammed et al., 2021). The components of GHG consist of carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O), which accumulate rapidly in the atmosphere, exacerbating global climate change (Mei et al., 2018). Global total GHG in 2016 were predominantly comprised of CO_2 gas at 79% (Ritchie et al., 2020). CO_2 concentrations grew by 46.64% between 1760 and 2019 and are estimated to increase by 64.07% by the end of the 21st century (Zhang et al., 2019). The higher concentration of CO_2 is likely attributed to population growth and global energy demand. Environmental, social, and economic instability is worsening due to the world's dependence on fossil fuels as energy sources (Kumar et al., 2022). Given the potential negative impact of CO_2 on well-being, it is important to consider how to design and implement policies to reduce these gas emissions (Barbier, 2014).

Numerous studies have examined factors influencing well-being, such as gender (Zweig, 2015), number of children (Shi, 2016), marital status (Ngoo et al., 2015), place of residence (Sørensen, 2021), health (Diener et al., 2018), financial conditions (Brown & Gray, 2016), social class (Yu & Blader, 2020), television (TV) ownership (Chadi & Hoffmann, 2021).

However, there has been limited investigation into the influence of CO_2 on well-being. Even to this day, there remains a debate regarding whether CO_2 has a significant impact or not. Anderson et al. (2012) found that greenhouse gas emissions do not have a strong correlation with subjective well-being. In contrast, Apergis & Majeed (2021) found that greenhouse gas emissions decrease well-being. This study adopts a subjective well-being approach, focusing on happiness and life satisfaction. We utilize a large dataset comprising 9,786 individuals from the World Values Survey (WVS). The geographical representation of the study will increase proportionally with the sample size.

The aim of this research is to determine the impact of CO_2 on subjective well-being using indicators of happiness and life satisfaction. This article is structured into an introduction, research methodology, results and discussion, and conclusion.

2. Research Method

This study utilizes secondary data from the seventh wave of the World Values Survey (WVS), conducted between 2017 and 2022. The WVS is an international research project that observes the transformations in social, environmental, and political aspects of society. The first study was conducted in 1981, employing the most comprehensive and rigorous research methodology among nations. The WVS comprises nationally representative surveys employing a standardized questionnaire administered in nearly 100 countries, encompassing approximately 90% of the global population. The WVS aims to assist scholars and policymakers in comprehending the evolution of societal ideas, values, and motivations across the globe. Government officials, journalists, students, and the World Bank team have extensively utilized this data (World Values Survey, 2022).

The WVS employs a stratified multistage random sampling method with two stages. Firstly, sample points are randomly selected based on region and urbanization levels. Secondly, individuals are randomly chosen. The survey is conducted through face-to-face interviews with a sample of individuals aged 18 and above. Meanwhile, respondents residing in remote locations are contacted via telephone with their consent (Baker, 2013). We utilize data from 9,724 ASEAN individuals from Indonesia (26,8%), Myanmar (12,3%), Thailand (9,3%), Vietnam (11,6), Malaysia (12,8%), Singapore (14,9%), and Philippines (12,2%).

An ordered probit regression is applied to examine the effect of CO_2 emissions on happiness and life satisfaction. This analysis is used because happiness and life satisfaction are ordinal dependent variables, which are sequential data with no meaningful distance between categories. The question for the happiness variable, as stated in the WVS questionnaire, is *"Q46: All things* considered*, would you say you are happy?"*. There are four response categories for this question: 1-not at all happy, 2-not very happy, 3-quite happy, and 4-very happy. Meanwhile, the life satisfaction variable is derived from the question *"Q49: All things considered, how satisfied are you with your life as a whole these days?"*. There are 10 response categories for the life satisfaction question, with 1-very dissatisfied and 10-very satisfied. CO_2 emissions data is also obtained from the same data source under the code "co2percap", indicating CO_2 emissions (metric tons per capita) based on the World Bank

database for the year 2016. Finally, the ordered probit regression model for this study is represented by the following equation (Greene, 2018):

$$Y_i^* = X_i\beta + \varepsilon_i$$

Where Y_i^* represents the dependent variable of happiness and life satisfaction; X_i denotes the explanatory variables observed, namely CO_2 per capita, age, gender, number of children, married, working fulltime, urban areas, class status, income level, TV ownership, and social media; β indicates the coefficients of the explanatory variables; ε_i denotes the error term; and i indicates the categories of happiness and life satisfaction (i=1-4 for happiness variables, while i=1-10 for life satisfaction variables).

In ordered probit analysis, it is known as a cut off or threshold for each category of happiness and life satisfaction. The ordered probit model is shown by the following equation:

$$Y_{ia} = \begin{cases} 1\ if\ Y_i^* \le a_1\ (Not\ at\ all\ happy) \\ 2\ if\ a_1 < Y_i^* \le a_2\ (Not\ very\ happy) \\ 3\ if\ a_2 < Y_i^* \le a_3\ (Quite\ happy) \\ 4\ if\ Y_i^* > a_3\ (Very\ happy) \end{cases} \qquad Y_{ib} = \begin{cases} 1\ if\ Y_i^* \le a_1\ (1) \\ 2\ if\ a_1 < Y_i^* \le a_2\ (2) \\ 3\ if\ a_3 < Y_i^* \le a_3\ (3) \\ 4\ if\ a_4 < Y_i^* \le a_4\ (4) \\ 5\ if\ a_5 < Y_i^* \le a_5\ (5) \\ 6\ if\ a_6 < Y_i^* \le a_6\ (6) \\ 7\ if\ a_7 < Y_i^* \le a_7\ (7) \\ 8\ if\ a_8 < Y_i^* \le a_8\ (8) \\ 9\ if\ a_9 < Y_i^* \le a_9\ (9) \\ 10\ if\ Y_i^* > a_9\ (10) \end{cases}$$

where Y_{ia} shows the happiness proxy score, while Y_{ib} shows the life satisfaction proxy score; a_1-a_4 (left) shows the cut off for the happiness category, while a_1-a_{10} (right) shows the cut off for the life satisfaction category.

3. Results and Discussion

The ASEAN community has an average happiness of 3,269, where the indicator range is 1-4 (1-not at all happy, 2-not very happy, 3-quite happy, and 4-very happy). This shows that happiness is quite happy and very happy. The average life satisfaction is 7.314, where the assessment score is 1-10. CO_2 per capita is 3,438 metric tons per capita. The average age and ownership of individual children is 41.278 years and 1.8 children. Based on gender, 48% of the ASEAN population is male. ASEAN is dominated by 68% who are married and 6% have full time employment status. 48% of the population comes from urban areas, where television ownership and social media use are 65.4% and 45% respectively. The average level of population health, satisfaction with finances, social status, and income scale respectively is 3.815 (scale 1-5); 6,481 (scale 1-10); 3,341 (scale 1-5); and 4,612 (scale 1-10).

Table 1. Descriptive Statistics of Research Variables

Variable	Definition	Mean	Std Dev	Min	Max
happiness	Feeling of happiness	3,269	0,658	1	4
satisfaction	Satisfaction with your life	7,314	2,212	1	10
co2percap	CO_2 emissions (metric tons per capita)	3,438	2,600	0,48	8,09
age	Age	41,278	14,437	18	103
sex	Sex (1 if male, 0 if female)	0,480	0,500	0	1
child	How many children do you have?	1,868	1,712	0	13
married	Marital status (1 if married, 0 if others)	0,684	0,465	0	1
fulltime	Employment status (1 if fulltime, 0 of others)	0,060	0,237	0	1
urban	1 if urban, 0 if rural	0,480	0,500	0	1
health	State of health	3,815	0,863	1	5
financial	Satisfaction with financial situation of household	6,481	2,401	1	10
class	Social class	3,341	0,972	1	5
income	Scale of incomes	4,612	2,063	1	10
tv	Information source: TV news	0,654	0,476	0	1
socmed	Information source: Internet	0,450	0,498	0	1

3.1. Happiness and life satisfaction

Figure 1 depicts the life satisfaction of the societies in Indonesia, Myanmar, Malaysia, the Philippines, Singapore, Thailand, and Vietnam. Indonesia has the highest level of life satisfaction with a score of 31.49, while the lowest life satisfaction score in Indonesia is 1.5. Myanmar has the highest satisfaction score at 30.08, Malaysia at 26.06, the Philippines at 27.19, and the lowest life satisfaction score at 2.44. Singapore has the lowest life satisfaction score at 0.9 and the highest life satisfaction score at 25.84. Meanwhile, Thailand has the highest life satisfaction score at 19.03 and Vietnam at 28.81. When comparing these countries, it is known that Indonesia has the highest life satisfaction of 23.85 compared to the other six countries (Myanmar, Malaysia, the Philippines, Singapore, Thailand, and Vietnam). Meanwhile, Malaysia ranks lowest in terms of life satisfaction among the other countries, at 5.77.

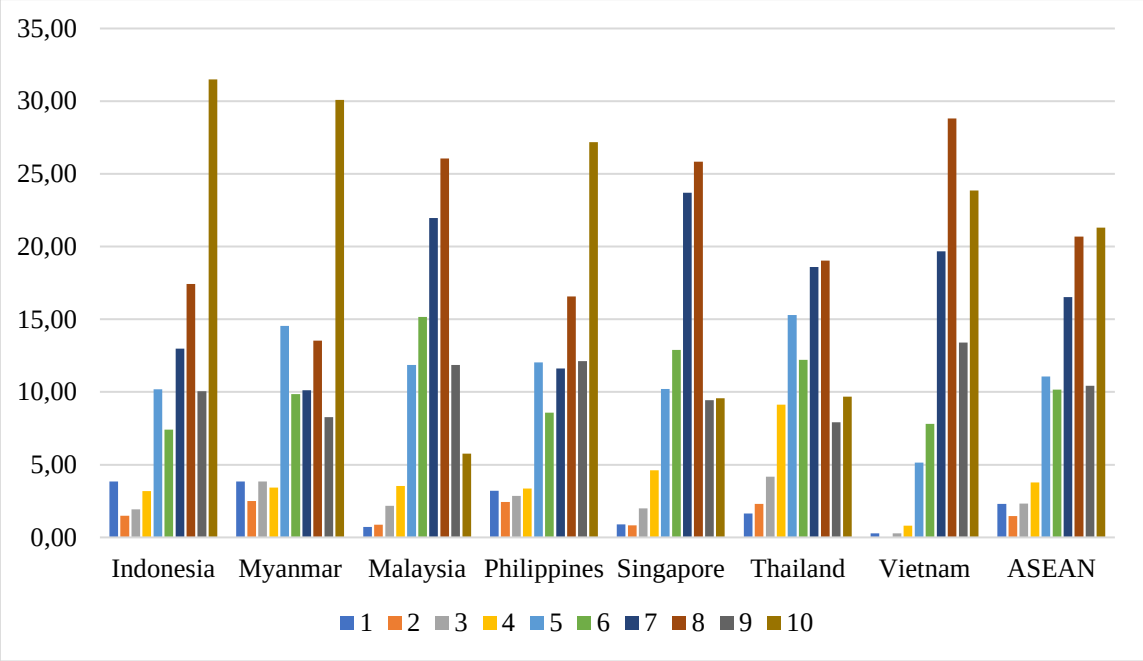

Figure 1. Life satisfaction of ASEAN residents using WVS data

Figure 2 depicts the happiness levels among ASEAN citizens. The highest score among Indonesian residents is that of moderate happiness, at 49.35. There is only one resident reporting unhappiness, while those feeling somewhat unhappy in Indonesia constitute 4.84, and those reporting high levels of happiness amount to 44.82. A majority of Myanmar residents express moderate happiness with a score of 54.3, equivalent to the proportion of moderately happy individuals in Malaysia, which stands at 66.64. Meanwhile, Filipinos report a high level of happiness at 51.18. The happiness levels in Singapore, Thailand, and Vietnam are categorized as moderate, with scores of 61.75, 51.49, and 49.2 respectively. Comparing the seven ASEAN nations, it is noted that six of them exhibit a moderate level of happiness. The exception is the Philippines, which reports a notably high level of happiness. Among the six nations with moderate happiness levels, Malaysia records the highest score. Myanmar reports the lowest happiness level at 3.43.

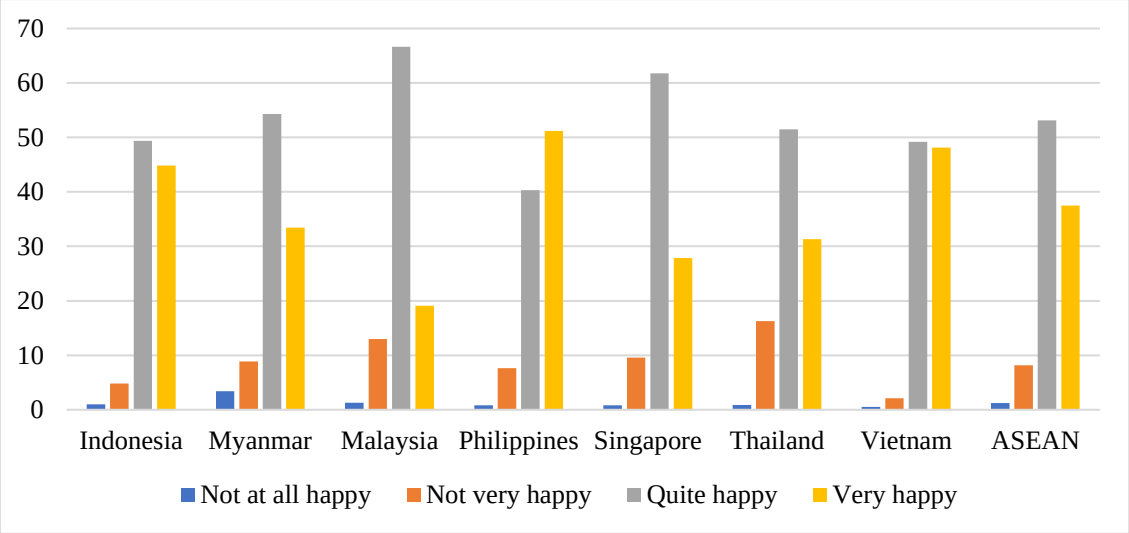

Figure 2. Happiness of ASEAN residents using WVS data

3.2. CO_2 emission

Figure 3 illustrates the per capita carbon dioxide (CO_2) emissions in metric tons for several countries in Southeast Asia. Malaysia exhibits the highest emissions at 8.09 metric tons per capita, followed by Singapore at 6.69 metric tons per capita. Thailand also registers relatively high emissions at 4.11 metric tons per capita. Meanwhile, Myanmar demonstrates the lowest emissions, standing at merely 0.48 metric tons per capita.

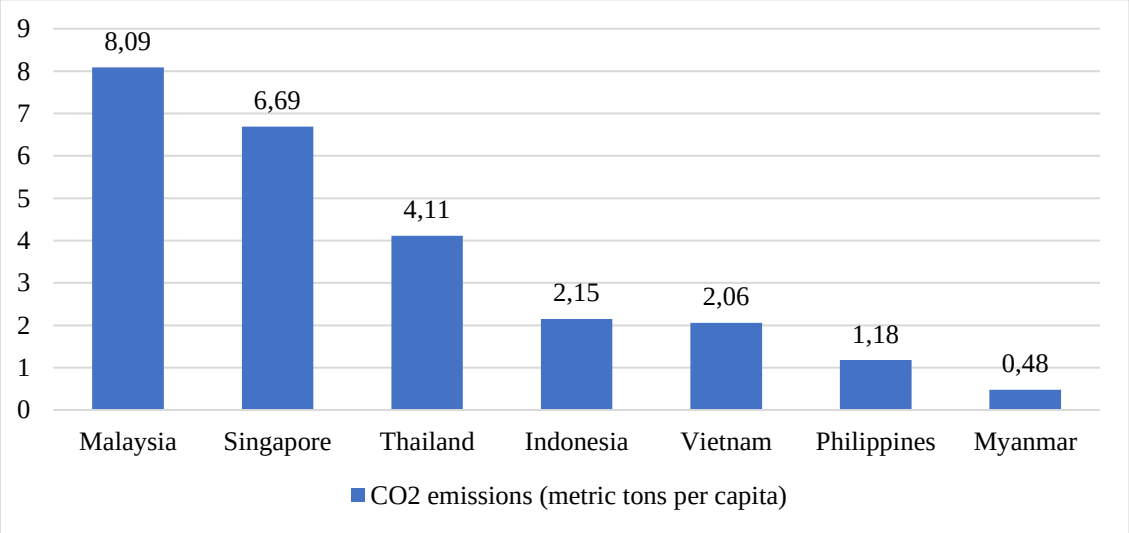

Figure 3. CO_2 emissions of ASEAN countries

The significant differences in CO_2 emissions per capita among these countries may be attributed to factors such as the level of industrialization, consumption of fossil fuels, and

utilization of renewable electricity. This assertion is supported by data obtained from the World Bank and Our World in Data using six indicators (Table 2). Firstly, Singapore exhibits the highest Electric Power Consumption (EPC) followed by Malaysia successively at 8844.69 and 4539.50 kWh per capita, respectively. Meanwhile, Myanmar has the lowest per capita electricity consumption at 220.39 kWh per capita. This aligns with findings from Salahuddin et al. (2018) which discovered that a 1% increase in electricity consumption would result in a 0.71% increase in CO_2 emissions. The causation is attributed to the use of fossil fuels as a source of electricity. This is in line with the second indicator, which indicates that Malaysia has the highest proportion of Fossil Fuel Energy Consumption (FFCTotal) to total energy consumption (96.63%), followed by Singapore (90.58%). Meanwhile, Myanmar has the lowest proportion of fossil energy consumption (44.29%). Thirdly, Singapore exhibits the highest Fossil Fuel Consumption per Capita (FFCCapita) (146258 kWh), indicating a very high level of energy consumption per individual. Fossil fuels are known to be a trigger for increasing CO_2 emissions. Li & Haneklaus (2021) found that a 1% increase in fossil fuel consumption leads to a long-term increase in CO_2 emissions per capita by 0.235%. Fourthly, Singapore has the highest GDP per Capita (82807.63 US$), while Myanmar has the lowest GDP per capita (1149.21 US$). Lane (2011) states that CO_2 and GDP are interrelated. GDP, which is a manifestation of economic expansion, can lead to an increase in CO_2 emissions. Renewable Electricity Output (REO) can be utilized to mitigate the risk of increased CO_2 emissions due to economic expansion. Myanmar has the highest REO (58.85%), indicating reliance on renewable energy. Meanwhile, Singapore has the lowest renewable electricity output (1.82%). Li & Haneklaus (2021) states that a 1% increase in REO consumption per capita in the long term will reduce CO_2 emissions per capita by 0.259%. Although Singapore has higher economic activity compared to Malaysia, its total CO_2 emissions are lower. The cause may be the Total Population (POP) of the respective countries Singapore is known to have the smallest population (5.64 million) compared to other ASEAN countries.

Table 2. Comparison of Energy Consumption, Fossil Fuel Usage, and Economic Indicators in ASEAN Countries

Indicator	Malaysia	Singapore	Thailand	Indonesia	Vietnam	Philippines	Myanmar
EPC	4539.50	8844.69	2483.56	808.42	1431.16	690.77	220.39
FFCTotal	96.63	90.58	79.84	66.09	69.82	62.43	44.29
FFCCapita	36361.00	146258.00	18179.00	8849.00	9510.00	4433.00	No data
GDP	11993.19	82807.63	6909.96	4788.00	4163.51	3498.51	1149.21
REO	9.96	1.82	8.54	10.65	36.73	25.41	58.85
POP	33.94	5.64	71.70	275.50	98.19	115.56	54.18

Note: EPC-Electric power consumption (kWh per capita), FFCTotal-Fossil fuel energy consumption (% of total), dan GDP-GDP per capita (current US$) are 2014 data. REO-Renewable electricity output (% of total electricity output) is 2015 data. POP-Total population (million people) is 2015 data (World Bank, 2024). FFCCapita-Fossil fuel consumption per capita (kilowatt-hours) is 2022 data (Ritchie et al., 2020).

3.3. The effect of CO_2 emission on happiness and life satisfaction

Table 3 shows the output of ordered logistic regression analysis revealing that health condition, financial status, and television ownership are factors influencing the increase in life satisfaction. Factors exhibiting a negative impact on life satisfaction include CO_2 emissions per capita and male gender. Meanwhile, factors positively influencing happiness encompass having children, marriage, health condition, financial status, income, and television ownership. Factors negatively impacting happiness consist of CO_2 emissions per capita, male gender, urban residency, socio-economic status (inverted), and social media ownership. The prob>chi^2 metric is utilized to determine the goodness-of-fit of a model, where the expected score should be less than 0.05. We obtained a prob>chi2 value of 0.000 for both the satisfaction and happiness models, indicating that there are no issues with these models. While some researchers might employ Pseudo R^2 to estimate the model's goodness-of-fit, we chose not to use it due to its differing interpretation from the R-squared in Ordinary Least Square analysis (Bruin, 2011; Nwakuya & Mmaduka, 2019).

Table 3. Output of Ordered Logistic Regression

Variable	Satisfaction				Happiness			
	Coeff.	z	P>z	Odd ratio	Coeff.	z	P>z	Odd ratio
Co2percap	-0.070 ***	-8.76	0.000	0,932	-0.120 ***	-12.66	0.000	0,887
age	-0.001	-0.37	0.711	0,999	-0.003	-1.58	0.114	0,997
sex (male)	-0.098 ***	-2.65	0.008	0,907	-0.178 ***	-4.21	0.000	0,837
child	0.012	0.83	0.406	1,012	0.040 **	2.54	0.011	1,041
married	0.066	1.52	0.129	1,069	0.161 ***	3.21	0.001	1,175
fulltime	0.061	1.50	0.133	1,063	0.019	0.40	0.689	1,019
urban	-0.063	-1.54	0.123	0,939	-0.107 **	-2.32	0.020	0,899
health								
2: Poor	-0.013	-0.05	0.962	0,987	0.199	0.68	0.498	1,220
3: Fair	0.379	1.45	0.148	1,461	0.512 *	1.81	0.070	1,668
4: Good	0.610 **	2.33	0.020	1,841	1.049 ***	3.72	0.000	2,856
5: Very good	0.883 ***	3.35	0.001	2,419	2.069 ***	7.28	0.000	7,918
financial								
2	-0.037	-0.22	0.825	0,964	0.186	1.14	0.253	1,204
3	0.329 **	2.28	0.023	1,389	0.105	0.73	0.463	1,110
4	0.714 ***	5.11	0.000	2,042	0.349 **	2.56	0.011	1,418
5	1.329 ***	10.40	0.000	3,776	0.596 ***	5.06	0.000	1,814
6	1.786 ***	13.68	0.000	5,963	0.677 ***	5.57	0.000	1,969
7	2.286 ***	17.60	0.000	9,839	0.839 ***	7.04	0.000	2,315
8	2.839 ***	21.62	0.000	17,104	1.101 ***	9.14	0.000	3,006
9	3.206 ***	22.61	0.000	24,673	1.362 ***	10.02	0.000	3,904

Variable	Satisfaction					Happiness				
	Coeff.		z	P>z	Odd ratio	Coeff.		z	P>z	Odd ratio
Satisfied	4.781	***	34.07	0.000	119,186	1.695	***	13.77	0.000	5,444
class										
Upper middle	-0.073		-0.43	0.664	0,929	-0.516	***	-2.78	0.005	0,597
Lower middle	-0.148		-0.89	0.373	0,862	-0.596	***	-3.26	0.001	0,551
Working	-0.040		-0.24	0.813	0,961	-0.509	***	-2.77	0.006	0,601
Lower	-0.007		-0.04	0.970	0,993	-0.598	***	-3.12	0.002	0,550
income	0.015		1.44	0.151	1,016	0.032	***	2.68	0.007	1,032
tv	0.154	***	3.91	0.000	1,166	0.299	***	6.65	0.000	1,349
socmed	0.010		0.25	0.806	1,010	-0.083	*	-1.71	0.087	0,921
Obs	9,724					9,724				
LR Chi2	4,353					1,961				
Prob>chi2	0.000	***				0.000	***			
Pseudo R2	0.110					0.104				

Note: ***, **, and * indicate significance of 1%, 5%, 10% respectively.

We found that an increase in CO_2 emissions per capita reduces life satisfaction and happiness among ASEAN residents. This result is related to the contribution of carbon dioxide to climate change. These findings are consistent with Kumari et al. (2021), who found that a 1% increase in CO_2 emissions leads to a 0.12% decrease in subjective happiness. CO_2 exacerbates climate change, leading to higher temperatures, increased rainfall, humidity, and wind speed. Consequently, there is a higher likelihood of droughts, floods, hurricanes, and other extreme weather events. These conditions can potentially cause crop failures (Priyanto, 2021), ultimately resulting in food insecurity and health issues in low- and middle-income countries (Taghizadeh-Hesary & Taghizadeh-Hesary, 2020). The climate crisis and the lack of climate technology also have long-term negative impacts on human happiness (Weijers & Agar, 2023). In several countries, such as China, Pakistan, and India, non-renewable energy consumption is the largest contributor to carbon emissions (Ansari et al., 2020; Chen et al., 2019). According to Lu & Sohail (2022), CO_2 emissions are considered the main cause of environmental damage and GHG. Global happiness levels decline due to greenhouse gases, while economic prosperity increases life satisfaction (Apergis & Majeed, 2021). Other sources indicate that well-being and environmental conditions are reciprocal. More prosperous individuals tend to care more about their environment, and people living in better environments tend to be more prosperous. In countries with higher average happiness levels, people also tend to be more energy-efficient (Zidanšek, 2007). People living in green environments have higher well-being and life expectancy (Lu & Sohail, 2022).

These conditions imply that ASEAN policies should invest more in green technology and green spaces to increase their accessibility and supply (Apergis & Majeed, 2021). Enhancing economic growth can reduce CO_2 emissions by prioritizing environmentally friendly growth,

sustainable happiness, and economic development (Kumari et al., 2021). Individual actions can maximize cumulative happiness, such as exercising, spending time with family, and shopping (Cloutier et al., 2020).

Our findings indicate that although women have higher levels of life satisfaction and happiness, this is associated with lower levels of affective balance. However, some literature mentions a paradox in the statement "women are happier than men," as women, despite being happier, are more likely to experience anxiety or depression (Zweig, 2015). Additionally, it is possible that certain social trends, such as increased neuroticism, decreased social cohesion, and increased household risk, have a greater impact on women than on men (Meisenberg & Woodley, 2015). An individual's subjective well-being tends to increase with the number of children. This result may be related to the belief that "the more children, the greater the well-being." Individuals expect their children to take care of them when they are old. This factor might also be influenced by the age of the children. However, some studies suggest that the influence of the number of children is also determined by their age (Kohler, 2015; Shi, 2016).

These findings indicate that married individuals have higher subjective well-being compared to other marital statuses. Joint activities, the absence of loneliness, and mutual emotional support contribute to the enhancement of individuals' subjective well-being (Ngoo et al., 2015; Wang & Wong, 2014). We also found that urban populations have lower happiness levels compared to rural populations. The most plausible reason is that rural communities have stronger social capital bonds and easier access to natural amenities compared to urban communities (Sørensen, 2021).

We use a baseline value of 1: Very Poor for this health variable. The study results indicate that healthier individuals have higher life satisfaction and happiness, as demonstrated by their increasing coefficient values. This finding is logical because healthy individuals have the freedom to engage in activities, whereas those with health issues are more likely to experience negative feelings daily. Previous research also found that individuals with higher levels of subjective well-being generally have better health and live longer. Those with high well-being levels are more likely to engage in healthy behaviors such as exercising, quitting smoking, and reducing alcohol consumption, which are significant factors contributing to their health. Additionally, an individual's psychological health appears to impact their endocrine, immunological, and cardiovascular systems (Diener et al., 2018). Better subjective well-being and health behaviors may be associated with higher self-efficacy, linked to behavioral change interventions that enhance positive affect. Conversely, healthy behaviors have the potential to increase subjective well-being (Stenlund et al., 2022).

Satisfaction with household finances was also found to influence subjective well-being. Households that are satisfied with their finances have higher subjective well-being. These results may be related to households taking on loans or debt. Households without debt are satisfied with household finances, so they have higher subjective well-being (Brown & Gray, 2016). We used an upper-class basis for this analysis. The results show that individuals with lower social status tend to feel less satisfied and less happy compared to those with higher social status. This is because individuals with upper-class status tend to have greater

autonomy, power, and control. Additionally, they are more respected in society (Anderson et al., 2012; Yu & Blader, 2020). Most research finds a positive relationship between individual/household income and happiness. Increases in household income are associated with higher life evaluations, more positive feelings, and lower levels of negative feelings. Higher income leads to greater optimism, financial happiness, and material well-being, significantly impacting subjective well-being (Diener & Tay, 2013).

The influence of TV on well-being remains debated. We found that TV increases well-being. Those who watch TV have higher life satisfaction and happiness, thereby reducing the likelihood of psychological issues such as depression (Chadi & Hoffmann, 2021). This finding could be considered in policy-making to enhance national happiness, as television is a cheap and effective instrument. This study confirms that social media is an important variable for predicting subjective well-being. This relates to social comparison theory, where an individual's happiness results from comparing themselves to others. This comparison can decrease one's subjective happiness when comparing themselves to happier individuals, as often depicted on social media (Bai et al., 2021).

4. Conclusions

This research aims to determine the effect of CO_2 on Southeast Asian subjective well-being using happiness and life satisfaction as indicators. Based on the Seventh World Values Surveys (2017-2021), Vietnam receives the highest average happiness and life satisfaction. On the other hand, Malaysia and Thailand receive the lowest average happiness and life satisfaction levels, respectively. This study uses an ordered probit regression to analyse secondary data collected from the Seventh World Values Surveys. Findings show that increasing CO_2 emissions per capita reduces the happiness and life satisfaction of Southeast Asians. Individual socio-economic variables, namely gender, health conditions, household financial conditions, and access to information from TV, positively influence their happiness and life satisfaction. The number of children, marital status, place of residence, information from social media, and income influence happiness.

The findings from this study seek to highlight the importance of reducing CO_2 emissions. However, this study has yet to analyse different sources of CO_2 emissions, such as non-human-made and human-made CO_2 emissions. Also, the limited analysis between countries has been acknowledged. Further research should incorporate sources of emissions into the examination and compare the results between countries. This research is a consideration for policy makers to improve well-being by reducing CO_2 emissions. Various measures have been implemented to reduce or stabilize GHG emissions, including the Kyoto Protocol in 2002, the Paris Agreement in 2015, and the United Nations Framework Convention on Climate Change of 1992 (UNFCC-1992). Any delay in reducing emissions will require more serious and expensive action in the future.

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