Electronic Journal of Applied Statistical Analysis
EJASA, Electron. J. App. Stat. Anal.
`http://siba-ese.unisalento.it/index.php/ejasa/index`
e-ISSN: 2070-5948
DOI: 10.1285/i20705948v17n1p20

Do the internet, economic growth, and environmental quality spur people's happiness during the Covid-19 pandemic?

By Dang, Thang, Ngoc

15 March 2024

Electronic Journal of Applied Statistical Analysis
Vol. 17, Issue 01, March 2024, 20-33
DOI: 10.1285/i20705948v17n1p20

Do the internet, economic growth, and environmental quality spur people's happiness during the Covid-19 pandemic?

Bui Hong Dang*[a], Do Van Thang†[a], and Bui Hoang Ngoc‡[a]

[a] *Ho Chi Minh City University of Industry and Trade, Address: 140 Le Trong Tan Street, Tan Phu District, Ho Chi Minh City, 70000, Vietnam*

15 March 2024

Factors affecting people's happiness have attracted much attention in the context of the COVID-19 pandemic. This paper was conducted to investigate whether internet use, economic growth, and environmental quality improvements can ease psychological darns caused by the COVID-19 pandemic. In the context of Southeast countries, and by applying the Bayesian inference, the findings of this study are summarized: (i) internet use and economic growth positively drive people's happiness; (ii) the effect of environmental quality on happiness is unclear in the context of the COVID-19 pandemic. Based on this evidence, the study suggests practical implications for policy-makers in boosting economic growth and enhancing people's happiness.

keywords: Bayesian inference, COVID-19 pandemic, Happiness, Economic growth, environmental quality.

1 Introduction

The World Health Organization (WHO) declared the novel coronavirus disease a pandemic on March 11, 2020. The COVID-19 epidemic, one of the biggest crises, has dramatically impacted all sectors, causing multidimensional and unprecedented tension

*Email: dangbh@huit.edu.vn
†Email: thangdv@huit.edu.vn
‡Corresponding authors: ngocbh@huit.edu.vn

ISSN: 2070-5948
http://siba-ese.unisalento.it/index.php/ejasa/index

worldwide. However, the pandemic has helped individuals recognize the value of happiness along with interest in healthcare protections and the prospects of the economy. Like other regions, the association of Southeast Asian nations (ASEAN) has been severely affected by the COVID-19 pandemic. There were 11,324,390 confirmed cases and 249,529 deaths as of September 17, 2021, in ten ASEAN countries (Chu et al., 2022). As a consequence, the growth in Malaysia unprecedentedly declined (17.1%), and the unemployment rate reached 17.7% in Indonesia (Chong et al., 2021), which has since led to much instability in human health and a profoundly reduced level of happiness. The outbreak of COVID-19 pandemic has caused profound effects on the global economy (Xiang et al., 2021; Franchetti et al., 2023). On the contrary, environmental issues during the COVID-19 quarantine period changed for the better. Most countries have seen significantly altered levels of air pollution. In the current information technology era, the internet, as one of the essential factors for economic, cultural, and social development, affects the quality of life of global people, and in social distancing, its role has increased so far. Therefore, this study investigates the relationship between happiness, economic growth, and the environment in ASEAN countries in 2021.

Nevertheless, an investigation of the specific determinants of national happiness for ASEAN countries during the pandemic is impossible within the frequentist framework. In frequentist econometrics, researchers always face small sample problems. Scarce data appear for some reasons, one of which is a naturally limited population (van der Lee et al., 2021). Consequently, collecting a sufficiently large dataset for inference is extremely difficult or impossible. In small sample sizes, frequentist estimation cannot give meaningful results, often leading to ”non-convergence, inadmissible parameter solutions, and inaccurate estimates” (Smid et al., 2020), ”low statistical power and level of relative bias” (Zondervan-Zwijnenburg et al., 2018). Thus, our work conducts a case study on the influence of specific factors on happiness using data on ASEAN countries to demonstrate the superiority of Bayesian methods over frequentist and even naive Bayesian estimation. The results achieved from Bayesian inference via Markov Chain Monte Carlo (MCMC) simulations show the effectiveness of Bayesian estimation in small-sample analyses.

2 Literature review

The concept of happiness is often used interchangeably with health, well-being, and quality of life or linked to comfort and health (Altomonte et al., 2020). Psychologists usually interpret happiness as subjective well-being (SWB), including cognitive and affective components (Olsson et al., 2013; Schimmack et al., 2008). The subjective assessment of one’s life, or life satisfaction, is referred to in the cognitive component; a higher level of life satisfaction denotes a higher degree of SWB or happiness. Affective factor has linked to the frequency with which people experience positive and negative affective states, encompassing particular emotions and general mood states. In this article, happiness is seen from a more holistic and interdisciplinary perspective because happiness must be a mental state that expresses satisfaction with aspects of life and is assessed by subjective evaluation (De Dear and Brager, 2002), not merely ”the absence of disease or infirmity”

(Grad, 2002).

2.1 The relationship between individual happiness and internet usage

The internet has transformed the way people interact, work, and entertain themselves. It has also been suggested to have an impact on people's happiness. Studies such as those by Helliwell et al. (2016) show a complex relationship between Internet use and happiness. They found that while internet use can provide numerous opportunities for social connection and information access, it might also lead to an increase in social comparison and unhappiness, fostering feelings of isolation and loneliness. One study found that individuals who spent more time on social media reported lower life satisfaction and self-esteem (Kross et al., 2013). Similarly, Shakya and Christakis (2017) supports this conclusion, asserting that online social networking is associated with decreases in self-reported physical health, mental health, and life satisfaction. However, Chou and Edge (2012) concluded that Internet usage can impact happiness negatively by creating an environment where users often compare their lives with others, leading to decreased self-esteem and happiness.

Contrarily, some researchers argue that the relationship between Internet usage and happiness is not always negative. For instance, Valkenburg et al. (2006) argue that online communication can also have positive impacts on psychosocial well-being, such as increased self-esteem and decreased feelings of loneliness. This positive impact is usually derived from fulfilling intimate relationships and supportive communication. Other studies have suggested that the internet can enhance happiness by facilitating social connections and social support. For example, online social support groups have been found to be effective in improving psychological well-being and reducing feelings of isolation among individuals with chronic illnesses (van Uden-Kraan et al., 2009). Additionally, online communication has been shown to increase social capital and social integration, which can contribute to greater happiness and life satisfaction (Quan-Haase and Wellman, 2004). Furthermore, some studies have found that the internet can provide individuals with opportunities for learning, creativity, and personal growth, which can contribute to overall happiness. For example, online learning has been found to increase self-esteem, motivation, and academic achievement (Cavanaugh et al., 2004). However, it is important to note that the impact of the internet on happiness is not universally positive. The internet can also be a source of stress and negative emotions. For example, exposure to negative news and online harassment can have detrimental effects on mental health and well-being (Tandoc Jr et al., 2015; Kassing and Sanderson, 2010). Overall, the existing research suggests that the relationship between the internet and happiness is complex and multifaceted. While the internet can provide opportunities for social connection, learning, and personal growth, it can also be a source of stress and negative emotions. Future research should further explore these relationships to better understand the impact of the internet on happiness.

2.2 The relationship between individual happiness and economic growth

Empirical results on the association between economic growth and happiness are ambiguous (Cai et al., 2023; Easterlin, 2015). While economic growth is often viewed as a critical indicator of a country's prosperity and success, it is not always clear whether it is associated with improved well-being for individuals. Some scholars found a positive relationship between them at individual and national levels. For example, Deaton (2008) concluded that "each doubling of GDP is associated with a constant increase in life satisfaction". Nevertheless, studies have shown that economic growth is positively associated with happiness and life satisfaction, but only up to a certain point (Clark et al., 2014). Beyond a certain threshold, increases in income or GDP do not seem to be associated with a corresponding increase in happiness. This is known as the Easterlin paradox, named after economist Richard Easterlin, who first identified this relationship in the 1970s. Some arguments are given as follows: first, happiness is a positive function of income but a negative function of aspiration, and while increasing with income, aspiration removes the positive effect of income. Second, economic growth is accompanied by increasing income inequality (Oishi and Kesebir, 2015).

Economic growth can also positively impact happiness through other channels, such as improved access to goods and services, increased employment opportunities, and improved health and education outcomes. For example, research has found that countries with higher levels of economic growth tend to have better health outcomes, such as lower infant mortality rates and longer life expectancy, which are positively associated with life satisfaction (Cole, 2019). Mahadea and Rawat (2008) argued that consumers should be able to spend more thanks to increased incomes, which should lead to more utility and subjective happiness. Rising incomes brought on by swift economic expansion help low-income nations reduce poverty and improve their citizens' quality of life. Therefore, the happiness of the poor increases with affluence.

However, economic growth can also have negative consequences for happiness, such as increased income inequality, social and environmental degradation, stress, and burnout from long working hours and high workloads. For instance, Oishi and Kesebir (2015); Olsson et al. (2013) showed that income inequality is negatively associated with happiness. Individuals living in countries with higher levels of income inequality tend to have lower levels of life satisfaction. In conclusion, the relationship between economic growth and happiness is complex and multi-faceted. While economic growth can lead to increased income, improved access to goods and services, and better health and education outcomes, it can also have negative consequences for individual well-being, such as increased income inequality, social and environmental degradation. The relationship between economic growth and happiness or life satisfaction also varies based on cultural and institutional factors and cannot be reduced to a simple linear relationship.

2.3 The relationship between individual happiness and environmental quality

The relationship between environmental quality and happiness or life satisfaction has been the subject of much research in recent years. The environment significantly impacts the human quality of life, which is reflected in the individual's subjective sense of happiness and life satisfaction. Initially, the idea that access to high-quality natural or artificial environments could increase happiness through biophilia an "innately emotional affiliation of human beings to other living organisms" was the theoretical underpinning of the relationship between happiness and the environment (Wilson, 1986, 2006). Tyrväinen et al. (2014) indicated that the quality of the environment could affect a person's mood, stress levels, and overall health. A clean and well-maintained environment with access to green spaces and clean air has positively influenced a person's happiness. In contrast, exposure to environmental pollution, noise, and overcrowding can lead to increased stress levels, anxiety, and decreased well-being.

Cuñado and De Gracia (2013) explored the relationship between air pollution, climate, and reported subjective well-being (or happiness) in Spanish regions. Evidence also suggested that climate and air pollution variables significantly explain these regional differences in happiness. Or Wang and Cheng (2017) used the 2010 and 2013 Chinese General Social Survey (CGSS) data to examine the relationships between the perceived severity of environmental issues and individual happiness. They found that the perceived severity of environmental issues has little, if not insignificant, correlation with happiness. Zheng et al. (2019) claimed that high levels of air pollution in China might contribute to the urban population's reported low level of happiness. People suffer the most on weekends, holidays, and days with severe weather. The expressed happiness of women and the inhabitants of the cleanest and dirtiest cities are more sensitive to air pollution. Meanwhile, Aksoy and Bayram Arlı (2020) mentioned that environmentally sustainable development has a positive influence on human happiness in 131 countries. To assure the countries' happiness, this aspect of sustainable development needs to be long-term protected. In order to provide for the comfort and pleasure of their citizens, underdeveloped nations have historically placed a greater emphasis on economic growth. Sadly, because of their disrespect for the environment, these countries' efforts have led to the depletion of their natural resources, the destruction of forests, and the contamination of water supplies (Knight and Rosa, 2011; Steinberger et al., 2012). Faced with these serious risks, national governments are gradually turning their attention to more sustainable values, combining economic development and improving the quality of life.

Additionally, environmental pollution has been significantly reduced during city lockdowns and production contraction. So, it is necessary to consider factors such as climate and environmental conditions when analyzing subjective well-being. Indeed, exposure to a healthy natural environment helps people increase their mental well-being by reducing stress and enhancing positive emotions. By contrast, happiness is diminished by low environmental performance (Rehdanz and Maddison, 2008), or ozone pollution (Ferrer-i Carbonell and Gowdy, 2007). Besides, the ecological footprint (EF) is added in this research because it is a vital indicator for measuring environmental sustainability and represents the ecological assets that a given population or product requires to produce the natural resources it consumes and to absorb its waste, especially carbon emissions (Kitzes et al., 2009). As research on EF and the happiness nexus is still limited, especially in developing countries, this study explores the relationship between these factors during the COVID-19 pandemic.

3 Research model and Methodology

Remarkably, most studies on happiness applied frequentist methods based on large samples. An analysis of happiness in the ASEAN context during COVID-19 is statistically inefficient because of the naturally limited population. Then, frequentist inference gives rise to some parameter bias. Nevertheless, on the contrary, Bayesian methods can produce meaningful outcomes by combining two information sources: data distribution and prior distribution. Long and Ngoc (2023) concluded that frequentist estimators, such as least square, maximum likelihood, or restricted maximum likelihood perform worse than Bayesian estimation under different prior settings. With specific priors incorporated, statistical power rises for structural parameters (Zondervan-Zwijnenburg et al., 2018). Bayesian inference using specific and data-dependent priors yields reliable results for both parameter types (Long and Ngoc, 2023).

"Are data large enough?" is a crucial question. Researchers often seek a solution in ratios of observations and parameters. Lee and Song (2004) suggested a ratio of 5:1, which can make a reliable conclusion from maximum likelihood, whereas bias might occur in a 3:1 ratio. However, a lower ratio, 3:1 instead of 5:1, is sufficient for Bayesian inference. A cross-section on happiness is accessed to demonstrate the superiority of Bayesian statistics in overcoming scarce data. With a dataset of nine ASEAN countries (excluding Cambodia and Timor-Leste for lack of data) for 2021, frequentist estimation might induce bias, while Bayesian results using specific priors are meaningful. According to Lee and Song (2004), some advantages of Bayesian inference compared to frequentist inference are: (*i*) Bayesian inference allows the incorporation of prior beliefs or information into the analysis. This is especially valuable when dealing with small sample sizes or situations where prior knowledge is available. Frequentist methods typically do not incorporate prior information; (*ii*) Bayesian inference provides a natural way to quantify and express uncertainty. In Bayesian analysis, you obtain a posterior distribution, which characterizes the uncertainty in the parameter estimates. Frequentist methods often provide point estimates (e.g., maximum likelihood estimates) without directly quantifying uncertainty, although confidence intervals can be used to approximate it; (*iii*) Bayesian methods are well-suited for sequential analysis, where data is collected over time, and the analysis can be updated as new data becomes available. In addition, Bayesian inference often provides more interpretable results, as the posterior distribution represents the probability distribution of the parameter of interest. This is in contrast to frequentist methods, which may sometimes produce estimates that are less intuitive.

3.1 Bayesian MCMC simulations

Since the late 1990x, statistics has witnessed a sharp rise in both methodological and empirical application of the Bayesian approach. A revolutionary change took place in econometrics thanks to the latest developments in software programs and the superior features of the Bayesian methodology. A Bayesian approach allows for approximating complex models or models too demanding for frequentist methods; Bayesian results are interpreted in a straightforward way; To involve model uncertainty is flexible in Bayesian inference; Bayes' law, a simple probability rule, is applied to all parametric models (Lee and Song, 2004; Long and Ngoc, 2023):

$$prob\left(\theta\left|y\right.\right) = \frac{prob\left(y\left|\theta\right.\right) * prob\left(\theta\right)}{prob\left(y\right)} \tag{1}$$

where, θ is a vector of unknown parameters, y is the data, $prob(\theta)$ is the prior distribution of the parameters θ. $prob\left(y\left|\theta\right.\right)$ is the likelihood distribution, $prob(y)$ is the marginal distribution of the data y, and $prob\left(\theta\left|y\right.\right)$ is the posterior distribution. In Bayesian inference, estimated coefficients are obtained from the posteriors, which state the likelihood of a parameter value of interest.

In particular, Bayesian estimation using specific priors are helpful in the case of small data sample sizes. The advantages of specific priors over non-informative priors are emphasized in many simulation studies (Zondervan-Zwijnenburg et al., 2018; Smid et al., 2020). Smid et al. (2020) divided priors into three types: naïve (non-informative), thoughtful (specific), and data-dependent. Naïve or data-dependent priors can be used as thoughtful priors under some circumstances. In the absence of background knowledge, Lee and Song (2004) advised specifying a data-dependent prior. Bayesian models using data-dependent priors perform better than frequentist and naively applied Bayesian estimation (Lee and Song, 2004). For variance, Zondervan-Zwijnenburg et al. (2018) recommended half-Cauchy or IG priors, while Smid et al. (2020) suggested non-informative IG(0.01,0.01) or very informative IG(0.5,0.5).

As Lee and Song (2004) mention, the structural parameters are normally distributed. With a focus on the crucial role of the internet during the pandemic, we assign a specific prior to variable internet penetration (INT), while default priors are set for the remaining parameters. A prior mean is extracted from the least square estimate. A sensitivity analysis is used to check how various prior specifications affect the posterior results. We vary values for the prior variance of INT in the range of 10,000 to 1. A variance of 10 or more is non-informative or vague compared to a strongly informative variance of 1.

3.2 Bayesian MCMC simulations

Our case study fits a Bayesian model:

$$Happiness = \beta_0 + \beta_1.EPI + \beta_2.EF + \beta_3.GDP + \beta_4.INT + u \tag{2}$$

We prepare β cross-sectional dataset of nine ASEAN nations in 2021. Happiness scores (labeled happiness), collected from World Happiness Report 2021, are calculated from six different components: life expectancy, social support, GDP level, freedom, corruption, and generosity. Environmental data, including the environmental performance index (EPI) and ecological footprint (EF), are recorded by the Yale Center for environmental law and policy, and the footprint data foundation, respectively. Data on gross domestic product per capita (GDP) and internet use (INT) are taken from the World Development Indicators (World Bank) (Data of internet use variable for Brunei, Myanmar, the Philippines, and Singapore updated to 2020). A 9:6 ratio of observations and parameters are obtained, that less than even 3:1. As Lee and Song (2004) documented, such a small dataset is useless for frequentists. Bayesian MCMC simulations can help in this case. To check chain convergence, a thinning of 30 along with separate blocking for all the parameters, is set in a MCMC size increased to 50000.

4 Empirical result

The OLS estimation results shown in Table 1 indicate that except for variable EF, the remaining variables are non-significant. That is because of insufficient data sample issues such as statistical power and inflated type II error. In this context, a thoughtful Bayesian MCMC approach allows us to obtain a much better solution.

Table 1: Frequentist (OLS) estimates

Variables	Coefficient	Std. Error	t	P > t	95% conf.interval
EPI	0.008	0.026	0.33	0.760	[-0.063; 0.080]
EF	-1.131	0.182	-6.22	0.003	[-1.636; -0.626]
GDP	0.000	0.000	4.92	0.008	[0.000; 0.001]
INT	0.041	0.011	3.93	0.017	[0.012; 0.071]
Intercept	4.558	0.584	7.81	0.001	[2.937; 6.179]

The Bayesian simulation outcomes under the thoughtful prior settings are presented in Table 2. The log marginal - likelihood estimate of this model (-38.230) is higher than that of the Bayesian model with naïve (default) priors (-51.114), that is, the Bayesian model using thoughtful priors performs better than the naïve Bayesian model.

By default, priors for the structural parameters and the variance parameter are N(0,10000) and IG(0.01,0.01), respectively. The results of the sensitivity analysis indicate that MCMC simulations using a strongly informative prior of N(0.04,1) perform the best. MCMC convergence diagnostics via cusum plots show no sign of non-convergence (Figure. 1).

The autocorrelation plots provide the similar results (Fig. 2). So, we can make infereces based on the simulation outcomes.

The posterior estimates of the selected model are exhibited in Table 1. Accordingly,

Table 2: Bayesian simulation results

Variables	Mean	Std. Deviation	MCSE	PPI
EPI	0.007	0.036	0.008	[-0.0690; 0.0694]
EF	-1.118	0.215	0.021	[-1.536; -0.674]
GDP	0.000	0.000	0.000	[0.00002; 0.00009]
INT	0.041	0.013	0.001	[0.013; 0.066]
Intercept	4.558	0.852	0.210	[3.114; 6.263]

Table 1 shows that compared to frequentist inference, thoughtful Bayesian estimation produces meaningful outcomes for all the variables. Concretely, EPI, GDP, and INT exert positive effects on the response, happiness. Moreover, the effect of EF is strongly negative. The robust and reliable results obtained provide new evidence of the superiority of a thoughtful Bayesian approach in the face of small sample issues. Some reasons are suggested to explain these findings as: (*i*) Economic growth typically leads to an increase in per capita income. Higher income can improve people's living standards, provide access to better housing, education, and healthcare, reduce financial stress, and positive impact on people's happiness (Ha et al., 2023); (*ii*) Economic growth can lead to increased investments in healthcare and education. Access to quality healthcare and educational opportunities can improve overall well-being and provide a sense of security for individuals and families (Ngoc and Hai, 2024); (*iii*) the internet provides a vast repository of information on virtually any topic. This easy access to knowledge allows people to learn, explore, and stay informed about Corona virus, which can lead to personal gain more understanding about the disease as well as how to prevent it in the context of COVID-19 pandemic. (*iv*) Last but not least, the internet offers a wide range of entertainment options, including streaming services, online games, and multimedia content. These sources of entertainment can help people relax, unwind, and enjoy their leisure time, contributing to happiness, and temporarily forget worries about illness and death in the context of COVID-19 pandemic (Van Tran et al., 2024).

5 Conclusion and policy implications

By performing a case study on the specific determinants of national happiness in the ASEAN context during COVID-19 era, our work demonstrated that in small sample research, with specific prior settings added, Bayesian analysis outperforms both naïve Bayesian and frequentist estimation, and more significantly, the more information included in the priors, the more accurate the posterior summary. The results show that EPI, GDP and INT positively affect the happiness of people in Southeast Asia during the COVID-19 pandemic. Meanwhile, the relationship between EF and happiness is

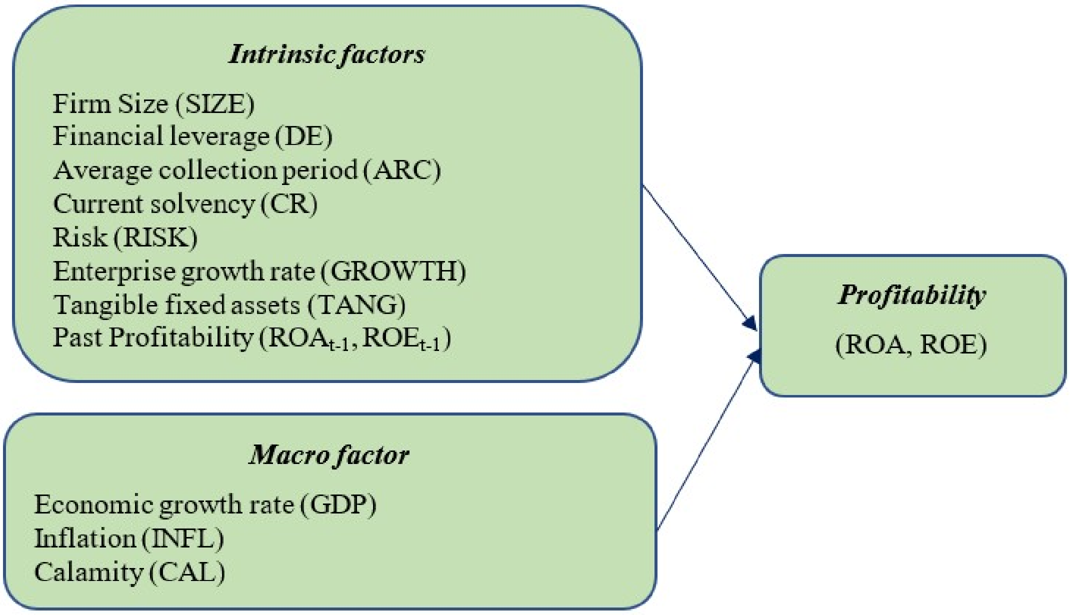

Figure 1: Cusum plots for MCMC convergence

negative. Furthermore, in contrast to frequentist inference, despite inadequate data, with a correctly specified prior, the Bayesian outcomes are meaningful and robust across different prior specifications. We recommend specifying thoughtful priors in applying Bayesian methods from the outcomes acquired, especially in small sample sizes.

Based on empirical results, some implication policies are suggested: (*i*) Firstly, governments can invest in the development of broadband infrastructure to ensure that everyone has access to affordable and high-speed internet. This will provide individuals with greater access to online resources and services, and help to bridge the digital divide; (*ii*) Additionally, governments can implement policies that promote economic growth, such as providing tax incentives to businesses and investing in infrastructure projects that create jobs. This can help to reduce poverty and increase overall economic stability, which can in turn lead to greater happiness and well-being; (*iii*) Finally, policies can be implemented to promote responsible internet use, such as protecting privacy rights and addressing online harassment and hate speech. By implementing these policies, governments can help to create a more equitable and supportive environment for internet use and economic growth, ultimately contributing to the happiness and well-being of their citizens.

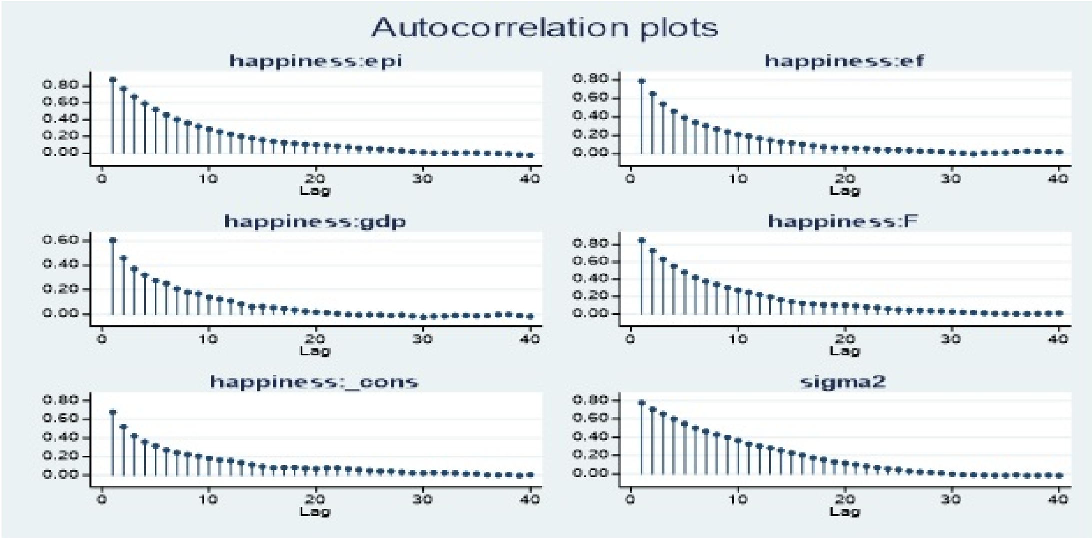

Figure 2: Autocorrelation plots for MCMC convergence

Acknowledgement

The authors thank the Editor-in-chief, Guest Editor and anonymous reviewers for helpful comments and suggestions. All errors are our.

References

Aksoy, F. and Bayram Arlı, N. (2020). Evaluation of sustainable happiness with sustainable development goals: Structural equation model approach. *Sustainable Development*, 28(1):385–392.

Altomonte, S., Allen, J., Bluyssen, P. M., Brager, G., Heschong, L., Loder, A., Schiavon, S., Veitch, J. A., Wang, L., and Wargocki, P. (2020). Ten questions concerning well-being in the built environment. *Building and Environment*, 180:106949.

Cai, H., Yuan, J., Su, Z., Wang, X., Huang, Z., Jing, Y., and Yang, Z. (2023). Does economic growth raise happiness in china? a comprehensive reexamination. *Social Psychological and Personality Science*, 14(2):238–248.

Cavanaugh, C., Gillan, K. J., Kromrey, J., Hess, M., and Blomeyer, R. (2004). The effects of distance education on k-12 student outcomes: A meta-analysis. *Learning Point Associates/North Central Regional Educational Laboratory (NCREL).*

Chong, T. T. L., Li, X., and Yip, C. (2021). The impact of covid-19 on asean. *Economic and Political Studies*, 9(2):166–185.

Chou, H.-T. G. and Edge, N. (2012). "they are happier and having better lives than i am": the impact of using facebook on perceptions of others' lives. *Cyberpsychology, behavior, and social networking*, 15(2):117–121.

Chu, D.-T., Vu Ngoc, S.-M., Vu Thi, H., Nguyen Thi, Y.-V., Ho, T.-T., Hoang, V.-T., Singh, V., and Al-Tawfiq, J. A. (2022). Covid-19 in southeast asia: current status and perspectives. *Bioengineered*, 13(2):3797–3809.

Clark, A. E., Flèche, S., and Senik, C. (2014). Economic growth evens-out happiness: evidence from six surveys.

Cole, W. M. (2019). Wealth and health revisited: Economic growth and wellbeing in developing countries, 1970 to 2015. *Social Science Research*, 77:45–67.

Cuñado, J. and De Gracia, F. P. (2013). Environment and happiness: New evidence for spain. *Social indicators research*, 112:549–567.

De Dear, R. J. and Brager, G. S. (2002). Thermal comfort in naturally ventilated buildings: revisions to ashrae standard 55. *Energy and buildings*, 34(6):549–561.

Deaton, A. (2008). Income, health, and well-being around the world: Evidence from the gallup world poll. *Journal of Economic perspectives*, 22(2):53–72.

Easterlin, R. A. (2015). *Happiness and economic growth–the evidence*. Springer.

Ferrer-i Carbonell, A. and Gowdy, J. M. (2007). Environmental degradation and happiness. *Ecological economics*, 60(3):509–516.

Franchetti, G., Politano, M., and Di Lorenzo, G. (2023). Stochastic analysis of covid19 impact on birth life expectation. *Electronic Journal of Applied Statistical Analysis*, 16(2):473–486.

Grad, F. P. (2002). The preamble of the constitution of the world health organization. *Bulletin of the World Health Organization*, 80:981–981.

Ha, N. M., Hoang Ngoc, B., and Vo, D. H. (2023). Does financial development affect human capital? evidence from vietnam. *Journal of Asia Business Studies*, 17(4):785–803.

Helliwell, J. F., Huang, H., and Wang, S. (2016). The distribution of world happiness. *World Happiness*, 8.

Kassing, J. W. and Sanderson, J. (2010). Fan–athlete interaction and twitter tweeting through the giro: A case study. *International journal of sport communication*, 3(1):113–128.

Kitzes, J., Galli, A., Bagliani, M., Barrett, J., Dige, G., Ede, S., Erb, K., Giljum, S., Haberl, H., Hails, C., et al. (2009). A research agenda for improving national ecological footprint accounts. *Ecological Economics*, 68(7):1991–2007.

Knight, K. W. and Rosa, E. A. (2011). The environmental efficiency of well-being: A cross-national analysis. *Social Science Research*, 40(3):931–949.

Kross, E., Verduyn, P., Demiralp, E., Park, J., Lee, D. S., Lin, N., Shablack, H., Jonides, J., and Ybarra, O. (2013). Facebook use predicts declines in subjective well-being in young adults. *PloS one*, 8(8):e69841.

Lee, S.-Y. and Song, X.-Y. (2004). Evaluation of the bayesian and maximum likelihood approaches in analyzing structural equation models with small sample sizes. *Multivariate behavioral research*, 39(4):653–686.

Long, N. T. and Ngoc, B. H. (2023). Is financial development good for ecological footprint? a bayesian multilevel mixed-effects analysis in asean countries. *International Journal of Environment and Sustainable Development*, 22(4):409–424.

Mahadea, D. and Rawat, T. (2008). Economic growth, income and happiness: An exploratory study. *South African Journal of Economics*, 76(2):276–290.

Ngoc, B. H. and Hai, L. M. (2024). Time-frequency nexus between tourism development, economic growth, human capital, and income inequality in singapore. *Applied Economics Letters*, 31(4):259–264.

Oishi, S. and Kesebir, S. (2015). Income inequality explains why economic growth does not always translate to an increase in happiness. *Psychological science*, 26(10):1630–1638.

Olsson, L. E., Gärling, T., Ettema, D., Friman, M., and Fujii, S. (2013). Happiness and satisfaction with work commute. *Social indicators research*, 111:255–263.

Quan-Haase, A. and Wellman, B. (2004). How does the internet affect social capital. *Social capital and information technology*, 113:135–113.

Rehdanz, K. and Maddison, D. (2008). Local environmental quality and life-satisfaction in germany. *Ecological economics*, 64(4):787–797.

Schimmack, U., Schupp, J., and Wagner, G. G. (2008). The influence of environment and personality on the affective and cognitive component of subjective well-being. *Social indicators research*, 89:41–60.

Shakya, H. B. and Christakis, N. A. (2017). Association of facebook use with compromised well-being: A longitudinal study. *American journal of epidemiology*, 185(3):203–211.

Smid, S. C., McNeish, D., Miočević, M., and van de Schoot, R. (2020). Bayesian versus frequentist estimation for structural equation models in small sample contexts: A systematic review. *Structural Equation Modeling: A Multidisciplinary Journal*, 27(1):131–161.

Steinberger, J. K., Roberts, J. T., Peters, G. P., and Baiocchi, G. (2012). Pathways of human development and carbon emissions embodied in trade. *Nature Climate Change*, 2(2):81–85.

Tandoc Jr, E. C., Ferrucci, P., and Duffy, M. (2015). Facebook use, envy, and depression among college students: Is facebooking depressing? *Computers in human behavior*, 43:139–146.

Tyrväinen, L., Ojala, A., Korpela, K., Lanki, T., Tsunetsugu, Y., and Kagawa, T. (2014). The influence of urban green environments on stress relief measures: A field experiment. *Journal of environmental psychology*, 38:1–9.

Valkenburg, P. M., Peter, J., and Schouten, A. P. (2006). Friend networking sites and their relationship to adolescents' well-being and social self-esteem. *CyberPsychology & behavior*, 9(5):584–590.

van der Lee, C., Gatt, A., van Miltenburg, E., and Krahmer, E. (2021). Human evaluation of automatically generated text: Current trends and best practice guidelines. *Computer Speech & Language*, 67:101151.

Van Tran, H., Tran, A. V., Bui Hoang, N., and Mai, T. N. H. (2024). Asymmetric effects of foreign direct investment and globalization on ecological footprint in indonesia. *Plos one*, 19(1):e0297046.

van Uden-Kraan, C. F., Drossaert, C. H., Taal, E., Seydel, E. R., and van de Laar, M. A. (2009). Participation in online patient support groups endorses patients' empowerment. *Patient education and counseling*, 74(1):61–69.

Wang, B. Z. and Cheng, Z. (2017). Environmental perceptions, happiness and pro-environmental actions in china. *Social Indicators Research*, 132:357–375.

Wilson, E. O. (1986). *Biophilia*. Harvard university press.

Wilson, E. O. (2006). *Naturalist*. Island Press.

Xiang, L., Tang, M., Yin, Z., Zheng, M., and Lu, S. (2021). The covid-19 pandemic and economic growth: theory and simulation. *Frontiers in Public Health*, 9:741525.

Zheng, S., Wang, J., Sun, C., Zhang, X., and Kahn, M. E. (2019). Air pollution lowers chinese urbanites' expressed happiness on social media. *Nature human behaviour*, 3(3):237–243.

Zondervan-Zwijnenburg, M., Depaoli, S., Peeters, M., and Van De Schoot, R. (2018). Pushing the limits. *Methodology*.