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Research Article

The Effect of Environmental Quality and Gender Inequality on Human Well-Being in Indonesia during Pandemic Covid-19

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Abstract

This study examines the impact of environmental quality and gender equality on human welfare in Indonesia from 2015-2020, using a panel database of 33 provinces. The results of the model selection testing with the Chow test and the Hausman test recommend regression analysis using the Fix Effect Model (FEM). This study resulted in the finding that there is a unidirectional and significant relationship between gender equality and human well-being. That means that gender inequality has the opposite effect. The second finding is that statistically, there is a positive relationship between environmental quality and human welfare in the case of provinces in Indonesia. The estimation results show that economic growth has a positive and significant relationship with human well-being in Indonesia. This study indicates that human well-being in Indonesia before and during the Covid-19 pandemic shows differences. The novelty of this study is to analyze the effect of gender equality and environmental quality indicators in influencing human welfare. In addition, this research also accommodates the Covid-19 pandemic period in an empirical model.

Keywords: Environmental quality; gender inequality; human well-being; FEM; pandemic Covid-19

1. Introduction

The world economic crisis caused by the Covid-19 pandemic has had a multiplier impact worldwide, including in Indonesia. The world's population faces problems that interfere with their health, mobility and economic activity. The adverse effects that arise are not only limited to soundness, income and the macroeconomy but also impact mental health, quality of happiness and overall well-being. (e.g., Banks and Xu, 2020; Davillas and Jones, 2021; Adams-Prassl et al., 2022). The Covid-19 pandemic is still engulfing many countries, including Indonesia. Handling is done from the health side, which is also in line with the recovery from the economic side. The National Economic Recovery Program (PEN) has been running since 2020. This year, the Government has allocated a budget of Rp. 699.43 trillion to finance the PEN program with a focus on health interventions, social protection programs, MSME support and other labour-intensive/priorities. As of June 18, 2021, the realization of the PEN budget has reached Rp. 226.63 trillion or 32.4% of the total budget (Kementerian Koordinator Bidang Perekonomian Republik Indonesia, 2021).

The definition and measurement of human well-being remain a discussion in the history of human life. Some opinions and understandings in the topic of discussion on human welfare can't tell the difference between individual welfare and social group welfare. That is because measuring human welfare is not easy. The selection of the right indicator as a representative variable to be studied is essential for researchers. McGillivray and Clarke (2006) point out that after the emergence of the Millennium Development Goals (MDGs) and Sustainable Development Goals (SDGs), human welfare has become a focus of several government agencies and academics and researchers.

In addition to welfare, the Millennial Development Goals document also contains demands for the importance of gender mainstream and improving environmental quality conditions. Agreements that explicitly commit to the extent of linking gender and environmental management include Environmental Conference in Stockholm, 1972. This international conference is the first to discuss environmental issues related to gender equality and women's issues (Mumtaz and Salway, 2009). In 1980 a World Conservation Strategy Conference was also held by The International Union for the Conservation of Nature (IUCN), the World Wildlife Fund (WWF), and the United Nations Environment Program (UNEP). The conference discussed the role of women's groups and the environment in improving the welfare of the world community. Several world and environmental meetings have been held since 1980 until now, which are chaired by world institutions such as the United Nations Conference on Environment and Development (UNCED). Various discussions on the relationship between environmental problems and community welfare are increasingly being formulated (Adams-Prassl et al., 2022).

Women are agents of change and significantly influence the quality of the environment. Women's roles as environmental agents are as follows (Meylan, 2014): 1) Reducing the use of cosmetics on a large scale. Furthermore, the remnants of cosmetic ingredients used are disposed of in their place or recycled. 2) Reducing excessive use of detergent and controlling the disposal of soapy wastewater by storing it in a particular place so that it is not directly dumped into the ground. As well as using environmentally friendly household consumption materials. 3) Women can play their role at home to control the production of plastic waste by saving plastic when shopping at the market by carrying bags that are used repeatedly to put goods or groceries. Women can also reduce plastic drinking bottle waste by bringing their drinks with them wherever they go and making it a habit for their families. 4) Women as mothers who manage all household matters such as cleaning the house and yard, can get used to doing things that are beneficial for the home environment and will be followed by other family members. That is conducted by getting used to the distribution of waste based on categories such as wet and dry waste by providing a special place to dispose of the different types of waste. For example, damp waste can be buried underground and made into compost. Meanwhile, dry waste such as paper and bottles can be recycled and used again. 5) Women as housewives who can become educators for their children. In this case, a mother can instil the values of environmental care in her children from a young age so that the child is accustomed to doing things that protect the environment wherever the child is. 6) A woman is someone who is actively planting in their respective home. At least, this can be a pillar for the movement of greening the environment around the place of residence. Women can be directly involved through an environmental organization and carry out direct socialization with each other. That is considered more accessible for other women to understand and accept. 7) As conscientious and thorough figures, women can turn waste problems into economic opportunities by utilizing waste into goods that can be used again after recycling. That is very useful to overcome the problem of waste because it can control and reduce waste in the environment. 8) Women can establish an environmental community that moves to invite other women to care about and preserve the environment around their settlements. That is conducted by distributing writings through the media so that the dissemination of information is more widespread and can be reached by the general public.

Acceleration of economic growth and environmental quality are challenges for economic development. Several alternative methods for measuring ecological problems include conventional

methods of descriptive analysis, environmental impact analysis, studies with non-market evaluation methods, and preference methods or life satisfaction approaches (Welsch, 2007; Welsch, 2009; Welsch and Ferreira, 2014), and are often used in environmental evaluation (Frey and Stutzer, 2012; MacKerron, 2012; Welsch and Ferreira, 2014). The preference method usually refers to evaluation studies. That is because the factors influencing happiness are likely subjective and qualitative. Several research findings show that more measurable variables, such as income, environmental quality, education level, and health quality, also affect happiness (Helliwell and Putnam, 2012; Welsch and Kühling, 2009). Environmental performance is also very influential on well-being and happiness, as shown by Ambrey and Fleming's (2014) research on biodiversity that improves people's welfare. Other studies collaborate on several environmental performance indicators, aspects of environmental quality and the quality of community happiness, including indicators of noise pollution (van Praag and Baarsma, 2005), pollution and water quality (Kustanto, 2020; Smyth et al., 2011) and lifestyle and demand for goods and services and environmentally friendly (Welsch, 2009) as well as research that influences business behaviour, government and pro-environmental economic activities (Ambrey and Fleming, 2014).

The issue that is often raised in various studies on the impact of environmental damage is air pollution. Air pollution spreads to different regions faster than other types of pollution (MacKerron and Mourato, 2009; Ambrey et al., 2014; Cuñado and de Gracia, 2013; Li et al., 2014; Zhang et al., 2020). Research related to environmental impacts using air emissions was carried out with various indicators, including using multiple types of pollutants such as PM₁₀ (Levinson, 2012); SO₂ (Ferreira et al., 2013; Luechinger, 2010); NO₂ and Pb (Welsch, 2007); and PM_{2.5} (Du et al., 2018), indicates the results of a negative impact on the welfare of the community. The magnitude of the effects on each pollutant is different and depends on each study's geographical area. Not much research has developed so far has produced findings about the relationship between green environmental behaviour and well-being. A survey conducted by Fuller et al. (2007) found that the quality of biodiversity increases the psychological benefits associated with an eco-friendly lifestyle. Studies in line with this include Ambrey and Fleming (2014), Carrus et al. (2015); Fleming et al. (2016); and Krekel et al. (2016). However, some studies have found that the development of green areas can lead to ambiguous feelings among users and some city dwellers. On the one hand, they enjoy positive environmental impacts. On the other hand, they have limited use of their resources for activities that have the potential to damage the environment (e.g., Bonnes et al., 2011; Carrus et al., 2005). This condition partially occurs in poor and developing countries where the level of education is still not high, as well as the euphoria of developing modern infrastructure and public facilities. Several research results suggest that air pollution may hurt well-being through the transmission of deteriorating health indicators (Mabahwi et al., 2014; Zhang et al., 2022).

During the Covid-19 pandemic, most urban areas experienced improvements in environmental quality. The actual value of urban green open space during the Covid-19 pandemic reduced air pollution and caused people's feelings of comfort to increase. However, there is not necessarily an increase in welfare because the income and economy of the community are experiencing a contraction. However, the community feels that good air quality needs to be supported by strong policies to control pollution and reduce the number of diseases caused by decay. In some areas, increasing green open space and rooms with good environmental quality status in urban areas has become the focus of government attention. Policies are needed to mitigate the risk of environmental pollution. That is because environmental risks that cause health problems will impact income expenditure, ultimately affecting human happiness and well-being. Often the result of efforts to improve the environment in the form of reducing pollution of water, soil and water takes a long time. However, a policy scenario, infrastructure development and a sustainable environmental impact control system are needed in various methods to realize a better environmental quality in the future (Jayasooriya et al., 2017).

The crisis caused by the shock of the Covid-19 pandemic demands the role of women in maintaining the welfare of their families. This study not only identifies the part of women's equality in

promoting human welfare in Indonesia but also analyzes the role of the environment in human well-being. The quality of the domain directly or indirectly plays an essential role in influencing the quality of welfare, health and other aspects. In addition to the two, the Covid-19 pandemic is also the focus of this study.

2. Methods

This study uses a panel data regression model. The data used in cross-section data from 33 provinces in Indonesia in the period 2015 - 2020. The panel data regression model is selected because it is considered adequate considering the short period and the adequacy of the number of provinces in Indonesia to be studied. This study uses a testing phase to select the best panel model with various tests, including the Redundant Fixed Effect Test and the Hausman Test.

The analysis was conducted using three independent variables that affect human welfare in Indonesia. The first variable is gender equality, which is hypothesized to affect human welfare positively. The second independent variable is the quality of the environment, which is hypothesized to impact human welfare positively. The third variable is the dummy period of the Covid-19 pandemic, which is hypothesized that the pandemic has an effect on human welfare differences before and after the Covid-19 crisis. The empirical model used refers to the research of Garikipati (2008) and Audi and Ali (2016), which is modified as equation 1:

$$HDI_{it} = f (IDG_{it}, EQI_{it}, Dummy_{it}) \quad (1)$$

HDI (Human Development Index) is the notation of the human development index, which represents the variable of human welfare. The IDG variable is a gender empowerment index that represents the gender equality variable. The environmental quality index in Indonesia is written with EQI notation. The dummy variable used in this study represents the pandemic period. The period before the pandemic represented a value of 0, and the period during the pandemic represented a value of 1. Equation 2 shows the regression model used in this study.

$$HDI_{it} = \beta_0 + \beta_1 IDG_{it} + \beta_2 EQI_{it} + \beta_3 Dummy_{it} + \varepsilon_{it} \quad ; \beta_1, \beta_2, \beta_3 > 0 \quad (2)$$

In equation (2) the research variables used are logged, so that the empirical model is written as equation (3)

$$\text{LogHDI}_{it} = \beta_0 + \beta_1 \text{LogIDG}_{it} + \beta_2 \text{LogEQI}_{it} + \beta_3 \text{Dummy}_{it} + e_{it} \quad (3)$$

Selection of the suitable model used the Redundant Fixed Effect Test and Hausman Test. This test was conducted to select the best model (Baltagi, 2005). Several steps of classical assumption testing are also applied as a condition for running the least squares econometric regression model (Gujarati and Porter, 2009). The test results will use whether the Common Effect Model or Pooled Least Square (PLS) approach, the fixed-effect model (FEM) approach or the Random Effect (REM) model is the most appropriate to represent the empirical model. PLS is a panel model approach by compiling time series data and cross-section data sequentially, without taking into account the dimensions of time and individuals. The FEM approach is a panel data approach which assumes that the regression equation varies between individuals and has a constant slope. Thus, the FEM approach takes that the slope coefficient of the regressor does not differ between individuals and over time. Meanwhile, using REM, the intercept is considered a random variable with an average value and is not constant (Gujarati and Porter, 2009).

3. Result and Discussion

The best model is selected with the Redundant Fixed Effect Test and the Hausman Test, which shows the results of the FEM model being the best used as an empirical model. Based on the redundant fixed affect test results, the appropriate model is FEM. The probability value of F is minor than alpha (0.05). Ho is rejected, and H1 is accepted (t Table 1). Subsequent testing still concludes that the best model is FEM rather than REM. Based on the results of the Hausman test, which show that the P-value of 0.000 is smaller than 0.05 (table 2).

Table 1. Redundant fixed effects tests.

Test cross-section fixed effects			
Effects Test	Statistic	d.f.	Prob.
Cross-section F	17.715406	(32,227)	0.0000
Cross-section Chi-square	258.542426	32	0.0000

Table 2. Correlated random effects – hausman test.

Test cross-section random effects			
Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	26.382165	3	0.0000

The stages of testing the assumptions of the classical model are also passed in this modelling. The regression model in this study is free from the problem of multicollinearity. Tests on the FEM model produce a VIF value above ten which means that this model passes the classical assumption - multicollinearity. The heteroscedasticity and autocorrelation tests using the White Test, Breusch-Pagan-Godfrey test, and the Glejser-test indicate that there are problems with heteroscedasticity and autocorrelation. However, the heteroscedasticity and autocorrelation problems found in the test results of this model were then solved using covariance modification according to the Heteroscedasticity and Consistent Autocorrelation (HAC) approach or the Newey-West standard (Gujarati and Porter, 2009).

The data processing results with the FEM approach resulted in a variable regarding gender having a positive and significant effect on human well-being in Indonesia. That is indicated by a probability value of 0.0145 or below the p-value of 5%. The second variable, namely the quality of the environment, also shows things that are by the hypothesis, which has a positive direction on welfare. The second variable is also significant, with a probability value below the p-value of 5% (0.0075). The estimation results for the dummy variable also show a statistically significant deal with a p-value below 5% and a negative value in the coefficient (table 3).

Table 3. Estimation result

Variable	Coefficient	Prob.
LOG(IDG)	1.205102	0.0145
LOG(EQI)	0.230230	0.0075
Dummy	-3.651854	0.0409
C	27.21452	0.0188

The results of this study show that gender equality has a positive and significant effect on environmental quality, with a coefficient of 1.205. An increase in gender equality indicators by 1 per cent affects human welfare in Indonesia by 1.20 per cent. The Covid-19 pandemic has had an impact on the decline in economic activity of the entire world population in all aspects. This health crisis's negative impact affects the quality of people's welfare (Adams-Prassl et al., 2022; Davillas and Jones, 2021; Banks and Xu, 2020). Several studies, such as those conducted by Banks and Xu (2020) and Davillas and Jones (2021), show empirical evidence that gender equality, quality of welfare and several indicators of other socio-economic variables positively affect environmental quality, but not significantly. The results of

the study during the pandemic, research in several countries showed a decline in several economic and social performances. The decrease in the scale of businesses and businesses during the pandemic period is also consistent with the available evidence, having a disproportionate impact on women.

The impact experienced by women is two times greater than that of the other gender. A study by Etheridge and Lisa (2022) stated that there was a more profound decline in well-being in women than men at the beginning of the pandemic. They say that in the April 2020 period, this different gender gap in well-being amounted to 0.18 standard deviations in their representative sample of research. The exploration of the results of this study is whether there are additional factors, from pre-existing household situations to changes in work situations to changes in loneliness and social aspects. The study also distinguishes between the different conditions men and women face and the effects of the same disease on mental well-being. The study's findings also showed that women were more exposed to domestic factors, and time use was associated with lower well-being. However, they show that other factors more common across the population play a more significant role overall. In particular, they documented essential gender differences in social aspects, with women reporting significantly higher increases in loneliness. Overall, the study results show that the impact experienced by women working is smaller than those who only work as housewives. That is because working women have time to interact more with other social environments other than only in the domestic household.

A positive coefficient value on the environmental quality index of 0.230 means that when the environmental quality index increases by 1 per cent, it will be able to increase human well-being in Indonesia by 0.23 per cent. This study's results align with the behaviour of data in empirical studies in other developing countries. The results of research conducted by Burke, T. A, et al. (2017), Simona-Roxana Ulman (2020) and Bibi, Chan e.al (2017). The dummy variable in the empirical model shows a significant value with a negative sign. The significance of the dummy variable indicates differences in the level of human well-being in Indonesia during the Covid-19 pandemic. The coefficient value of -3.65854 suggests that the difference in welfare decreased by 3.65 per cent from conditions before the Covid-19 pandemic. This finding is in line with the actual needs released by the Central Statistics Agency, which states that the component of welfare in Indonesia, namely the quality of health and education of the Indonesian people, has increased.

In contrast, in terms of adjusted per capita expenditure, it has decreased. Human development indicators in Indonesia and the world are affected by the crisis caused by the Covid-19 pandemic. Data in Indonesia shows that the growth in the human development index slowed by 71.94 per cent in 2020. However, this figure still grew by 0.03 per cent or an increase of 0.02 points compared to the previous period's achievement. The decline strongly influences the HDI growth slow in 2020 in the adjusted average per capita expenditure. This indicator fell from IDR 11.30 million in 2019 to IDR 11.01 million in 2020 (Bibi and Ali, 2017).

The results of this study also agree with the analysis of Simona-Roxana Ulman (2020), which states that there is a positive and significant relationship between welfare; and urban green coverage. This result is also consistent with previous research, which found a negative impact of air pollution on well-being (Bibi and Ali, 2017). The study of Carrus et al. (2015) also provides evidence of the positive effect of green open spaces on well-being. The negative association of air pollution with people's life activities is explained by the impact of smog on people's mobility. In addition, the effect on health is deteriorating. The coverage of quality environmental conditions has a high correlation with welfare. Green ecological conditions that produce healthy air will have the effect of improving the quality of public health. However, research results also show a negative relationship between air degradation and welfare variables in the long term, which is statistically more significant than air pollution in the short term.

4. Conclusions

Empirical findings show that gender equality and environmental quality variables have a very significant effect on human well-being in Indonesia. Crisis conditions caused by the Covid-19 pandemic. Gender equality improves welfare because the role of women is very central in education and family health. In addition, the more modern the characteristics of society, the role of women in supporting the family's income and economy is also getting bigger. Environmental variables are also indirectly influenced by the role of women in improving their quality, but this study has not directly identified the role of women in environmental quality in Indonesia. In particular, this study analyzes the effect of the pandemic period on welfare. The Covid-19 pandemic that hit Indonesia and the world indirectly contributed to the environment. This is because there are restrictions on production and transportation activities as well as reduced human mobility, making the residue produced from the process of these activities also reduced. However, this study has not specifically analyzed the different effects of the Covid-19 pandemic on environmental quality in Indonesia. The novelty of this research is the use of indicators of environmental quality and gender equality in influencing welfare in Indonesia. However, this study has the limitation that the independent variables, which can actually have mutual influence, have not been studied and modeled empirically in more depth.

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