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# Threshold Levels of Environmental Quality and Fiscal Decentralization on Economic Growth in Indonesia before, during and after COVID-19 Pandemic

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## Abstract

Environmental quality can stimulate a certain level of economic growth. Besides, the fiscal decentralization will enhance economic growth by improving a better condition for a local government budget. In the COVID-19 pandemic, the government should work hard to address a higher level of economic growth. Therefore, the threshold levels of environmental quality and fiscal decentralization can be assessed to maintain economic growth in the long-run. This study estimates the threshold levels of environmental quality and fiscal decentralization on economic growth for 34 provinces in Indonesia before, during and after COVID-19 pandemic. The cross-section threshold regression was employed. The findings reveal that before COVID-19 pandemic the threshold levels of fiscal decentralization and environmental quality were 15.18% and 74.97, respectively. During COVID-19 pandemic these levels were 15.32-27.33% and 74.71-74.97, respectively. Meanwhile, after COVID-19 pandemic these levels were 11.99% and 77.69, respectively. Therefore, the local policymakers should manage the local fiscal policy under prudent and sustainable patterns to enhance the local economic growth. They should also pay more attention to qualify the certain level of environmental quality to guarantee the local green growth.

**Keywords:** environmental quality, fiscal decentralization, economic growth, COVID-19 pandemic, static threshold regression
**JEL Classification:** C68, F43, L52

## INTRODUCTION

The Corona Virus Disease 2019 (COVID-19) suppresses the Indonesian economic growth in 2020 to the negative level about –2.07%. Conversely, in 2019 the economic growth displays a glory condition at the level of 5.05%. This condition asserts that the central and local governments work together and synchronize macroeconomic policies to maintain macroeconomic stability under

fiscal decentralization and sustainable environment framework. Therefore, the optimal (threshold) levels of environmental quality and fiscal decentralization can be assessed both in the normal economic condition and economic crisis. The threshold level will provide a better level of environmental quality and fiscal decentralization to stimulate economic growth.

Chudik, Mohaddes & Raissi (2021) and Auerbach, et al (2022) found that during COVID-19 most governments adopt a unique and an effective fiscal stimuli. The impact of macroeconomic uncertainty on government expenditure brings a low level of expenditure multiplier in high uncertainty macroeconomic regime (Jerow & Wolff, 2022). Furthermore, Su, et al (2022) note that the governments have responded a distress signal of global warning in the form of green economic development and low carbon policies for financial sectors. In particular, the government of China has conducted a green credit and a strict environmental regulation to control a significant level of air pollution (Huang & Tian, 2023).

This study examines the optimal (threshold) levels of environmental quality and fiscal decentralization on economic growth for 34 provinces in Indonesia in 2019 (before COVID-19), 2020 and 2021 (during COVID-19), and 2022 (after COVID-19). Besides, this study contributes to the existing literature in several ways. First, this study emphasizes threshold levels of environmental quality and fiscal decentralization on economic growth before, during and after COVID-19 pandemic. Second, this study sets a cross-section threshold regression. Third, this study delivers benefits for the policy makers to consider threshold levels of environmental quality and fiscal decentralization in stimulating a local economic development and sustainability.

The findings of this study can be pointed out in several ways. First, the threshold levels of fiscal decentralization on economic growth for 34 provinces before, during and after COVID-19 pandemic were 15.28%, 15.32-27.33%, and 11.99%, respectively. Second, at the same time the threshold levels of environmental quality on economic growth were 74.97, 74.71-74.97, and 77.69, respectively.

Chakravarty & Mandal (2020) argue that developing countries face two challenges to qualify economic growth-environmental quality. First, these countries should increase the level of economic growth and alleviate poverty rate. Second, developing countries face institutional constraint to conduct strict environmental regulations by considering economic growth and fighting poverty. In particular, China has conducted a strict environmental regulation to control environmental problem and to enhance economic growth (Fang, et al, 2023; and Huang & Tian, 2023).

Furthermore, fiscal decentralization can also determine the level of economic growth. Canavire-Bacarreza, Martinez-Vazquez & Yedgenov (2020) note that the last three decades there have evidenced an unparalleled a higher level of decentralization reforms in developed, developing and transitional countries. The decentralization reforms were determined by some reasons include the efficiency of government service delivery to obtain a higher economic growth, to mitigate the conflict and to preserve territorial unity, and an efficient system of public services at a local level. Therefore, the economic growth-fiscal decentralization nexus was a two-way causality. Besides, fiscal decentralization can be set as a tool of public service to stimulate per capita income (Wang, et al, 2021). The condition means

that fiscal decentralization will provide a better welfare level for local people. Huang (2023); Sun, Gao & Razzaq (2023); and Zhang & Xiang (2023) found that fiscal decentralization enhanced local economy, renewable energy and environmental sustainability in China. Similarly, Kuai, et al (2019) and Lin & Zhou (2023) argued that fiscal decentralization-environmental quality nexus will determine economic growth.

The significant contribution of fiscal decentralization-environmental quality nexus on economic growth can be traced through a channel of technology (Cheng, et al, 2021). Other channels also provide a significant contribution such as institutional quality (Escaleras & Chiang, 2017), and trade diversification (Fang & Fang, 2023).

This study was organized into some sections. The first section was introduction. The second section was method, while the third section was result and discussion. The last section was conclusion and policy implication.

## METHOD

### The Data

This study sets some data to qualify the threshold levels of fiscal decentralization and environmental quality on economic growth for 34 provinces in Indonesia in the years of 2019-2022. The data are collected from the publication of Central Bureau of Statistics and Ministry of Finance.

Economic growth for all provinces has an average value about 5.81%, -1.36%, 5.48% and 5.76% during four years (Table 1). The condition means that during COVID-19 pandemic (2020), most provinces obtain the lowest level of economic growth. However, before and after COVID-19 pandemic these provinces take a beneficial impact of the positive rate of economic growth. Therefore, the central and local governments have an appropriate way and policy to enhance and stabilize domestic economy.

The labor force and foreign direct investment (FDI) portray the quality of local economic growth and development. The higher labor force and FDI lead the higher economic growth. Moreover, the level of environmental quality increases every year. For example, the mean value of environmental quality index (IKLH) in 2019 2020, 2021 and 2022 were 67.20, 71.02, 72.11 and 73.07, respectively. The condition points out that most provinces can maintain and increase the quality of environment in a better way. However, the fiscal decentralization level indicates that most provinces are unable to guarantee local fiscal independence. Simply words, the central government still transfers a lot of development funds to the local governments.

This study selects some explanatory variables to determine the local economic growth. These variables include unemployment rate, poverty rate, information and communication technology, and human development index. The unemployment rate during COVID-19 pandemic (2020) is higher than before and after COVID-19 pandemic (2019 and 2022). The condition illustrates that the COVID-19 pandemic creates new unemployment space. However, the poverty rate can be maintain at the level of 10%. Besides, the human development index (HDI) can also be maintain at the level of 71% before and during COVID-19 pandemic. Conversely, after COVID-19 pandemic HDI is little bit lower than before and

during COVID-19 pandemic. The level of information and communication technology is at the level of 5% before and during COVID-19 pandemic.

**Table 1**. Data and Descriptive Statistics

| Variables | 2019 | | | 2020 | | | 2021 | | | 2022 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Mean** | **Min.** | **Max.** | **Mean** | **Min.** | **Max.** | **Mean** | **Min.** | **Max.** | **Mean** | **Min.** | **Max.** |
| Economic growth (eg), data are presented in %. | 5.81 | 2.8 | 15.72 | -1.36 | -9.34 | 4.92 | 5.48 | 0.51 | 18.96 | 5.76 | 2.01 | 22.94 |
| Total labor force (llb), data are transformed into logarithm. | 5.06 | 4.09 | 6.38 | 6.35 | 5.04 | 7.38 | 6.36 | 5.04 | 7.39 | 1.84 | 1.80 | 1.89 |
| Foreign direct investment (lfdi), data are transformed into logarithm. | 2.51 | 1.00 | 3.77 | 2.47 | 0.81 | 3.68 | 2.49 | 1.12 | 3.72 | 2.75 | 1.45 | 4.66 |
| Environmental quality index (iklh), data are presented in an index. | 67.20 | 42.84 | 83.96 | 71.02 | 52.98 | 79.75 | 72.11 | 54.43 | 81.80 | 73.07 | 54.65 | 84.22 |
| Unemployment rate (uer), data are presented in %. | 4.56 | 1.40 | 7.91 | 5.49 | 3.01 | 9.91 | 6.03 | 3.32 | 10.95 | 4.97 | 2.34 | 8.31 |
| Poverty rate (pr), data are presented in %. | 10.35 | 3.45 | 27.04 | 10.81 | 4.45 | 26.80 | 10.43 | 4.56 | 27.38 | 10.30 | 4.53 | 26.80 |
| Fiscal decentralization level (fdl), data are presented in %. | 19.79 | 3.84 | 73.37 | 19.15 | 4.35 | 66.95 | 20.61 | 5.26 | 63.46 | 22.45 | 5.27 | 72.49 |
| Information and communication technology (ICT), data are presented in an index. | 5.29 | 3.29 | 7.27 | 5.56 | 3.35 | 7.46 | 5.78 | 3.35 | 7.66 | Not available | | |
| Human development index (hdi), data presented in an index. | 71.21 | 60.84 | 80.76 | 71.16 | 60.44 | 80.77 | 71.55 | 60.62 | 87.18 | 69.91 | 8.64 | 81.67 |

Source: BPS and Ministry of Finance

**The Econometric Technique**

The significant contribution of fiscal decentralization and environmental quality on economic growth have been discussed by Ding, McQuoid & Karayalcin (2019); Canavire-Bacarreza, Martinez-Vazquez. & Yedgenov (2020); and Ajanaku & Collins (2021). Besides, in the macroeconomic perspective, the Solow Growth Model can be set to address the basic issue of determinant factors of economic growth. Therefore, this study proposes the threshold regression of fiscal decentralization and environmental quality under the Solow Growth Model.

Furthermore, the econometric technique uses a Cross-section threshold regression (Hansen, 1996 and 2000). The basic equation of cross-section regression of the fiscal decentralization and environmental quality on economic growth can be written as follows:

$$EG_i = \alpha_0 + \beta_1 LLB_i + \beta_2 LFDI_i + \beta_3 HDI_i + \beta_4 X_i + \beta_5 Z_i + \varepsilon_i \quad (1)$$

EG denotes economic growth for 34 provinces. Meanwhile, LLB, LFDI and HDI are labor force in the logarithm, foreign direct investment in the logarithm, and human development index, respectively. In particular, X represents fiscal decentralization level or environmental quality index. Besides, Z equals information and communication technology, unemployment rate, and poverty rate. The Z will be applied to determine the significant contribution of environmental quality on economic growth. The i indicates 1, 2, ….n. The α and β are constant and parameter of independent variables, respectively. The ε is error term. The $\beta_2 - \beta_3$ should more than (>) zero or a positive impact on economic growth.

The equation (1) can be formulated to express the cross-section threshold regression model, resulting:

$$EG_i = (\beta_1 X_i + \lambda_1 Y_i) I(X_i \leq \gamma) + (\beta_2 X_i + \lambda_2 Y_i) I(X_i > \gamma) + \varepsilon_i \quad (2)$$

X expresses the threshold variables include fiscal decentralization level or environmental quality index. Y is all explanatory variables, namely: LLB, LFDI, HDI and Z. The $\gamma$ shows the unknown threshold parameter, while *I(.)* equals an indicator function of low or high regime. In addition, $\varepsilon$ is the error term.

The Equation (2) can be drawn in threshold form as follows:

$$EG_i = \begin{cases} \beta_0^1 + \beta_1^1 X_i + \beta_2^1 Y_i + \varepsilon_i, & X_i \leq \gamma \\ \beta_0^2 + \beta_1^2 X_i + \beta_2^2 Y_i + \varepsilon_i, & X_i > \gamma \end{cases} \quad (3)$$

$\beta^1_1$ illustrates the parameter for provinces with low regime, while $\beta^2_1$ describes the parameter for provinces with high regime.

## RESULTS AND DISCUSSION

### The Main Findings

The threshold levels of fiscal decentralization before COVID-19 pandemic was about 15.28% (Table 2). The condition displays that most provinces in Indonesia are not able to provide funding of local development independently. Besides, the central government transfer leads growing the local economy and welfare.

In particular, Regime 1 provides a better understanding the impact of labor force (LLB), foreign direct investment (LFDI) and human development index (HDI) on economic growth by considering fiscal decentralization. LLB and HDI deliver significant and negative impacts on economic growth at the 1% level. The higher LLB and HDI drive the lower economic growth. However, LFDI can stimulate economic growth in 2019 at the 1% level. The condition means that the higher FDI leads the higher economic growth for selected provinces in Indonesia. Besides, the R-squared of Regime 1 is the highest level about 77%. The number observation of Regime 1 is about 15 provinces.

**Table 2**. Fiscal Decentralization Threshold on Economic Growth in Indonesia before COVID-19 Pandemic

| | **Global OLS** | **Regime1 (q<=15.28)** | **Regime2 (q>15.28)** |
|---|---|---|---|
| Intercept | 23.85*<br>(11.51) | 44.51***<br>(9.08) | -10.25**<br>(3.90) |
| LLB | -0.97<br>(0.67) | -2.32*<br>(1.13) | 0.73*<br>(0.34) |
| LFDI | 0.91<br>(0.81) | 2.30***<br>(0.77) | -0.18<br>(0.22) |
| HDI | -0.22<br>(0.14) | -0.46***<br>(0.11) | 0.16***<br>(0.04) |
| R-squared | 0.74 | 0.77 | 0.34 |
| Heteroskedasticity Test (P-Value) | 0.55 | | |
| Threshold: Fiscal Decentralization Level | 15.28 | | |
| 0.95 Confidence Interval | [10.10,21.08] | | |
| LM-test for no threshold | 8.46 | | |
| Bootstrap P-Value | 0.18 | | |
| Observation | 34 | 15 | 19 |

Notes: The standard errors are reported in parentheses. ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively.

During COVID-19 pandemic, the threshold level of fiscal decentralization on economic growth were about 27.33% and 15.32%, respectively (Table 3). In 2020, Regime 2 portrays that economic growth is determined by LLB and LFDI at the level of 5% by considering fiscal decentralization for 6 provinces. The higher LLB and LFDI enhance the higher economic growth. Besides, the R-squared is about 88%. The findings explain that during the early of COVID-19 pandemic the local governments should need more money to resist the significant impact of COVID-19 on the local economy. Therefore, during the period the dependency level of local fiscal to the central fiscal is higher compared to that of before COVID-

19 pandemic. Consequently, the central government has transferred much money to the local economy under economic recovery programs.

The central government conducts fiscal stimulus programs from 2020-2021 to stabilize and enhance domestic economy. The impact of the programs can be illustrated on the threshold level of fiscal decentralization on economic growth in 2021. In 2021, the threshold level of fiscal decentralization is about 15.32% for 13 provinces. The condition means that the local governments still face a higher dependency fiscal ratio to the central government. This period is a recovery regime after the significant impact of COVID-19 pandemic during 2020.

During 2021, the economic growth was determined by LLB, LFDI and HDI under Regime 1. LLB and HDI have a significant and negative impact on economic growth at the 1% level. The higher level of labor force and HDI produce the lower level of economic growth. However, LFDI has a significant and positive impact on economic growth at the 1% level. The higher FDI stimulates the higher of economic growth. Besides, the R-squared is about 71%. The level of R-squared under Regime 1 is higher than that of under Global OLS and Regime 2.

**Table 3**. Fiscal Decentralization Threshold on Economic Growth in Indonesia during COVID-19 Pandemic

| | **2020** | | | **2021** | | |
|---|---|---|---|---|---|---|
| | **Global OLS** | **Regime1 (q<=27.33)** | **Regime2 (q>27.33)** | **Global OLS** | **Regime1 (q<=15.32)** | **Regime2 (q>15.32)** |
| Intercept | 22.34*** (6.83) | 16.73** (6.03) | -52.10*** (17.82) | 14.59 (13.03) | 24.54 (13.82) | -2.64 (8.91) |
| LLB | -0.17 (0.14) | -0.06 (0.11) | 3.61** (1.53) | -0.46** (0.17) | -0.86*** (0.27) | -0.39** (0.14) |
| LFDI | 0.66 (0.60) | 0.91 (0.65) | 3.75** (1.31) | 2.59** (1.15) | 6.48*** (1.53) | 0.39 (0.50) |
| HDI | -0.34*** (0.10) | -0.27*** (0.08) | 0.15 (0.14) | -0.18 (0.19) | -0.40** (0.17) | 0.11 (0.11) |
| R-squared | 0.53 | 0.29 | 0.88 | 0.60 | 0.71 | 0.09 |
| Heteroskedasticity Test (P-Value) | 0.60 | | | 0.83 | | |
| Threshold: Fiscal Decentralization Level | 27.33 | | | 15.32 | | |
| 0.95 Confidence Iterval | [13.18,27.33] | | | [15.32,18.96] | | |
| LM-test for no threshold | 7.93 | | | 6.50 | | |
| Bootstrap P-Value | 0.24 | | | 0.50 | | |
| Observation | 34 | 28 | 6 | 34 | 13 | 21 |

Notes: The standard errors are reported in parentheses. ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively.

**Table 4**. Fiscal Decentralization Threshold on Economic Growth in Indonesia after COVID-19 Pandemic

| | Global OLS | Regime1 (q<=11.99) | Regime2 (q>11.99) |
|---|---|---|---|
| Intercept | 40.93<br>(53.49) | -1175.90***<br>(279.12) | -33.11<br>(34.44) |
| LLB | -20.96<br>(28.81) | 394.89***<br>(103.16) | 19.32<br>(17.88) |
| LFDI | 2.29**<br>(0.88) | 11.84***<br>(2.22) | 1.43<br>(0.89) |
| HDI | -0.04<br>(0.03) | 6.31***<br>(1.27) | -0.01<br>(0.01) |
| R-squared | 0.73 | 0.89 | 0.23 |
| Heteroskedasticity Test (P-Value) | 0.76 | | |
| Threshold: Fiscal Decentralization Level | 11.99 | | |
| 0.95 Confidence Interval | [11.99,11.99] | | |
| LM-test for no threshold | 6.22 | | |
| Bootstrap P-Value | 0.39 | | |
| Observation | 34 | 6 | 28 |

Notes: The standard errors are reported in parentheses. ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively.

The threshold level of fiscal decentralization after COVID-19 pandemic is about 11.99% (Table 4). This threshold level is lower than that of during COVID-19 pandemic. The condition describes that during economic recovery and growth the local governments needs more fiscal stimulus programs from the central government. The local governments did not able to collect the higher level of local revenue to enhance local economy.

Under Regime 1, the economic growth was determined by LLB, LFDI and HDI at the 1% level. The higher level of labor force, foreign direct investment, and human development index drive the higher level of economic growth. The condition delivers a positive signal for 6 provinces in Indonesia that the labor market, investment climate and human quality life create a better local economic development. Besides, the R-squared is about 89%.

Furthermore, Table 5 shows the threshold level of environmental quality index before COVID-19 pandemic. The threshold level is about 74.97. The condition portrays that the quality of environment in Indonesia is on the right path. On the other words, the higher level of environmental quality index illustrates the higher the quality of human life and environment. Besides, the economic growth is determined by labor force (LLB), foreign direct investment (LFDI), information and communication technology (ICT), unemployment rate (UER) and poverty rate (PR) under Regime 2.

LLB has a significant and negative impact on economic growth at the 5% level, while UER has a significant and negative effect at the 1% level. The condition describes that the higher LB and UER stimulate the lower economic growth for 8 provinces. Moreover, LFDI, ICT and PR have a significant and positive impact on economic growth at the 1% level. The condition carries out that the higher FDI, ICT and PR create the higher economic growth. In addition, the R-squared is about 94%.

**Table 5**. Environmental Quality Threshold on Economic Growth in Indonesia before COVID-19 Pandemic

| | **Global OLS** | **Regime1 (q<=74.97)** | **Regime2 (q>74.97)** |
|---|---|---|---|
| | 4.63 | 0.41 | 5.29 |
| Intercept | (2.76) | (2.40) | (3.81) |
| | -1.54** | -0.10 | -1.70** |
| LLB | (0.60) | (0.33) | (0.69) |
| | 1.70** | 0.66 | 2.38*** |
| LFDI | (0.66) | (0.53) | (0.49) |
| | 0.61 | 0.69** | 2.15*** |
| ICT | (0.43) | (0.26) | (0.62) |
| | -0.31 | -0.26 | -2.13*** |
| UER | (0.16) | (0.14) | (0.40) |
| | 0.28*** | 0.11* | 0.39*** |
| PR | (0.08) | (0.05) | (0.04) |
| R-squared | 0.77 | 0.24 | 0.94 |
| Heteroskedasticity Test (P-Value) | 0.78 | | |
| Threshold: Environmental Quality Index | 74.97 | | |
| 0.95 Confidence Interval | [67.00,74.97] | | |
| LM-test for no threshold | 12.46 | | |
| Bootstrap P-Value | 0.09 | | |
| Observation | 34 | 26 | 8 |

Notes: The standard errors are reported in parentheses. ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively.

During COVID-19 pandemic, the threshold level of environmental quality is about 74.71 (Table 6). This condition reveals that the quality of environment before and during COVID-19 pandemic is not significantly different. At the same time, the economic growth is affected by LLB, LFDI, ICT, UER and PR under Regime 2. LLB, LFDI, ICT and PR have a significant and positive impact on economic growth at the 15 level. Therefore, the local governments can stimulate labor marker, foreign investment, and technology to enhance local economic growth. However, UER has a significant and negative impact on economic growth at the 1% level. In addition, the R-squared is about 99%.

Furthermore, in 2021 the threshold level of environmental quality reaches 74.97. The threshold levels before (2019) and during (2021) COVID-19 pandemic are the same. Besides, 2021 is the recovery period from COVID-19 pandemic. The economic growth has been influenced by LLB and LFDI under Global OLS for 34 provinces. LLB has a significant and negative impact on economic growth at the 10% level. Meanwhile, LFDI has a significant and positive effect on economic growth at the 10% level. In addition, the R-squared is about 89%.

**Table 6**. Environmental Quality Threshold on Economic Growth in Indonesia during COVID-19 Pandemic

| | 2020 | | | 2021 | | |
|---|---|---|---|---|---|---|
| | Global OLS | Regime1 (q<=74.71) | Regime2 (q>74.71) | Global OLS | Regime1 (q<=74.97) | Regime2 (q>74.97) |
| Intercept | 4.91 | 6.89 | -118.98*** | 8.35 | 3.66 | -20.17 |
| | (4.39) | (4.96) | (3.60) | (8.82) | (3.20) | (15.08) |
| LLB | -0.14 | -0.16 | 9.35*** | -0.36* | -0.31*** | -0.46 |
| | (0.10) | (0.11) | (0.39) | (0.17) | (0.10) | (1.45) |
| LFDI | 0.85 | 0.85 | 0.85*** | 3.24* | 0.35 | 8.58*** |
| | (0.59) | (0.60) | (0.22) | (1.18) | (0.44) | (0.88) |
| ICT | -1.32 | -1.61 | 11.34*** | -1.07 | 0.15 | 0.89 |
| | (0.75) | (1.00) | (0.38) | (1.47) | (0.68) | (1.39) |
| UER | -0.22 | -0.17 | -3.62*** | -0.59 | -0.04 | 0.74 |
| | (0.26) | (0.29) | (0.12) | (0.43) | (0.21) | (0.44) |
| PR | 0.09 | 0.02 | 1.30*** | 0.08 | 0.05 | 0.19 |
| | (0.09) | (0.11) | (0.03) | (0.13) | (0.09) | (0.12) |
| R-squared | 0.62 | 0.35 | 0.99 | 0.89 | 0.28 | 0.91 |
| Heteroskedasticity Test (P-Value) | 0.65 | | | 0.88 | | |
| Threshold: Environmental Quality Index | 74.71 | | | 74.97 | | |
| 0.95 Confidence Iterval | [74.70,74.71] | | | [74.97,75.04] | | |
| LM-test for no threshold | 6.69 | | | 11.7 | | |
| Bootstrap P-Value | 0.87 | | | 0.09 | | |
| Observation | 34 | 26 | 8 | 34 | 23 | 11 |

Notes: The standard errors are reported in parentheses. ***, ** and * indicate significance at 1%, 5% and 10% levels, respectively.

After COVID-19 pandemic, the threshold level of environmental quality is better. The threshold level is about 77.69 (Table 7). The condition delivers a positive signal that all provinces in Indonesia are able to maintain the quality of environment in a more appropriate way. However, the estimation model of the threshold level of environment quality on economic growth after COVID-19 pandemic did not consider the contribution of ICT. The ICT during 2022 did not available properly as an explanatory variable.

In particular, the economic growth has been determined by LLB, LFDI and UER under Regime 2. LLB and UER have a significant and negative impact on economic growth for 7 provinces at the 1% level. The higher labor force will suppress the level of economic growth. Similarly, the higher UER stimulates the lower economic growth. This condition is a right path that the large number of unemployment rate after COVID-19 can undermine the certain level of economic growth in selected provinces in Indonesia. Furthermore, LFDI leads the higher level of economic growth at the 1% level. During 2022, the Indonesian government fights hard to attract foreign investors. The foreign investors can contribute in building some main national projects and in buying some financial asserts in Indonesian capital market. Consequently, at that time, the economic growth was growing well.

**Table 7**. Environmental Quality Threshold on Economic Growth in Indonesia after COVID-19 Pandemic

| | Global OLS | Regime1 (q<=77.69) | Regime2 (q>77.69) |
|---|---|---|---|
| Intercept | 97.64<br>(68.56) | 20.02<br>(11.81) | 653.75***<br>(44.09) |
| LLB | -49.94<br>(36.47) | -8.74<br>(6.27) | -355.92***<br>(24.23) |
| LFDI | 2.62***<br>(0.90) | 0.56*<br>(0.26) | 8.23***<br>(0.22) |
| UER | -1.23<br>(0.62) | -0.08<br>(0.14) | -4.05***<br>(0.29) |
| PR | -0.12<br>(0.09) | -0.01<br>(0.04) | -0.06<br>(0.06) |
| R-squared | 0.96 | 0.25 | 0.99 |
| Heteroskedasticity Test (P-Value) | 0.36 | | |
| Threshold: Environmental Quality Index | 77.69 | | |
| 0.95 Confidence Iterval | [77.69,77.69] | | |
| LM-test for no threshold | 8.55 | | |
| Bootstrap P-Value | 0.29 | | |
| Observation | 34 | 27 | 7 |

Notes: The standard errors are reported in parentheses. ***, ** and * indicate significance at 1%, 5% and 10% levels, respectively.

## Discussion

This study estimates the threshold levels of fiscal decentralization and environmental quality before, during and after COVID-19 pandemic for 34 provinces in Indonesia. The cross-section threshold regression was applied. The main findings can be revealed in several ways. First, before and after COVID-19 pandemic, the threshold levels of fiscal decentralization on economic growth reach about 15.28% and 11.99%, respectively. Second, the threshold levels of fiscal decentralization during COVID-19 pandemic were 27.33% (2020) and 15.32% (2021), respectively. Third, the threshold levels of environmental quality on economic growth before and after COVID-19 pandemic were 74.97 and 77.69, respectively. Fourth, the threshold levels of environmental quality during COVID-19 pandemic reach about 74.71 (2020) and 74.97 (2021), respectively.

Adzawla, Sawaneh and Yusuf (2019) note that Sub-Saharan Africa (SSA) countries are one of the most vulnerable to climate change. These countries are characterized by low economic development, high dependence on natural resources for agricultural production and low technological advancement. They reveal that the economic growth- environmental quality nexus occurs in the short-run. However, the decreasing relationship economic growth- environmental quality nexus happens in the long-run. In particular, Ajanaku and Collins (2021) note that deforestation contributes to the environmental problem and connect to the poverty level, population explosion, and indebtedness level. Therefore, Blampied (2021) suggests that developing countries should conduct a strategy “grow first, then clean up” and a policy “clean up in order to grow”.

Moreover, Liu, et al (2020) found that the relationship between environmental regulation on environmental pollution was a non-linear effect. It

means that the governments should propose an innovative regulation and practice to control the level of pollution. Specifically, Su, et al (2022) suggest that green economic development and finance can be employed. Consequently, the government can facilitate green technology innovation to enhance green economic development and finance.

Economic growth can also be stimulated by a certain level of fiscal decentralization. Canavire-Bacarreza, Martinez-Vazquez and Yedgenov (2020) found a higher expenditure decentralization leads a higher economic growth for 67 countries for the period of 1981–2012. The revenue decentralization also contributes significantly to push economic growth. Therefore, a change in in fiscal decentralization will determine a certain level of economic growth.

## CONCLUSION

This study investigates the threshold levels of environmental quality and fiscal decentralization on economic growth for 34 provinces before (2019), during (2020 and 2021) and after (2022) COVID-19 pandemic. The cross-section threshold regression was employed.

The main findings demonstrate that all provinces in Indonesia are not able to develop local economy independently. They need central government transfer to enhance local economic growth and development. Moreover, the local governments have stimulated the better quality of environment before, during and after COVID-19 pandemic. In particular, before and after COVID-19 pandemic, the threshold levels of fiscal decentralization on economic growth reach about 15.28% and 11.99%, respectively. At the same time, the economic growth was determined by several explanatory variables under Regime 1. Second, the threshold levels of fiscal decentralization during COVID-19 pandemic were 27.33% (2020) and 15.32% (2021), respectively. Third, the threshold levels of environmental quality on economic growth before and after COVID-19 pandemic were 74.97 and 77.69, respectively. Besides, the economic growth was affected by several explanatory variables under Regime 2. Fourth, the threshold levels of environmental quality during COVID-19 pandemic reach about 74.71 (2020) and 74.97 (2021), respectively.

This study delivers a local macroeconomic policy by considering the local revenue and high quality of environment. In addition, the local policymakers should pay more attention to identify local revenues and manage local natural resources in an appropriate way. Consequently, the local policymakers can guarantee the local green growth. They can also work hard to attract the higher number of foreign direct investment and increase the level of information and communication technology (ICT).

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