Journal of Governance and Accountability Studies (JGAS)
ISSN 2774-6739, Vol 4, No 1, 2024, 31-41 *https://doi.org/10.35912/jgas.v4i1.1981*

Government Size and Digital Inequality in Indonesia

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Article History
Received on 20 February 2024
1st Revision on 1 March 2024
2nd Revision on 20 June 2024
3rd Revision on 3 June 2024
Accepted on 7 June 2024

Abstract
Purpose: This study aims to analyze the impact of government size in the field of infrastructure on digital inequality in Indonesia.
Research Methodology: This study uses panel data analysis with the Common Effect Model (CEM), Fixed Effect Model (FEM), and Random Effect Model (REM) approaches using research samples from the Central Bureau of Statistics, Ministry of Finance, and International Telecommunication Union in Indonesia.
Results: The results indicate that government-sized infrastructure has a negative and significant effect on the Information and Communication Technology (ICT) Index, while the square government-sized infrastructure or infrastructure expenditure optimization effect has a positive and significant impact on the ICT Index, and the implementation of the infrastructure budget supports digital equity.
Conclusions: This study examines the impact of government size on digital inequality in Indonesia at the regional level, using data from 2016–2020. The results show that a smaller government size has a positive impact on the ICT Index, while a larger government size leads to a negative, nonlinear effect on regional ICT indices.
Limitation: This study was limited to the national level of each region in Indonesia.
Contributions: This study aims to serve as a reference for government considerations in strategic policies related to infrastructure spending and issues of the technology change strategy.
Novelty: This study contributes to the existing literature by exploring the critical role of government spending on infrastructure in bridging the digital divide in Indonesia, with a particular focus on digital infrastructure.

Keywords: *Digital Inequality, Government Infrastructure, Gross Domestic Product*

How to Cite: Yulianita, A., Subardin, S., & Zulfikri, Z. (2024). Government size and digital inequality in Indonesia. *Journal of Governance and Accountability Studies*, 4(1), 31-41.

1. Introduction

Digital technology advancements have enormous potential to improve human well-being, increase economic development and productivity, and create new and better employment to replace outdated ones. Regretfully, institutions and policies have been sluggish in adapting to new difficulties posed by the digital economy. Digitalization in Indonesia is characterized by rising internet usage among Indonesians (Khrystoslavenko & Grubliauskas, 2022). In January 2020, there were 175.4 million internet users from 2019 to 2020 in Indonesia, representing an increase of 25 million growth in the number of Internet users in Indonesia (Fitriani, Nugroho, Samsiyah, Fitriyani, & Kusbiarsi, 2025; Junistia, Nearti, & Jayanti, 2025; Yahaya, Salahudeen, & Zubairu, 2021).

In the last five years, Indonesia's Information and Communication Technology (ICT) has developed rapidly. The development of several indicators for the use of ICT in Indonesia shows the most rapid development of ICT indicators in household use of the Internet, reaching 78.18%. The growth followed in Internet usage in households among the population using cellular phones in 2020, reaching 62.84%. Computer ownership in households in 2020 is expected to increase to 18.83%. The population using the Internet also increased during the 2016–2020 period, as shown by the increase in the percentage age of Internet access in 2016, from around 25.37% in 2016 to 53.73% in 2020. The household ownership of fixed wireline telephones has decreased. From year to year, in 2016, the percentage age of households owning or operating wired telephones was around 3.49%, dropping to 1.65% in 2020 (BPS, 2021).

Regarding Internet subscription activity, the number of active mobile broadband subscribers per 100 residents has increased from 2020. The number of fixed broadband subscribers per 100 residents has also increased in 2020. The increase in the number of Internet subscribers, both mobile broadband and fixed broadband, shows the phenomenon of increasing Internet use in society during the COVID-19 pandemic to support online activities. Meanwhile, the number of fixed telephone subscribers has declined. In 2020, there will be three–four fixed-line subscribers per 100 residents. The development of internet penetration in Indonesia has also continued to experience a positive trend, from 25.37% in 2016 to 53.73% in 2020. This increase in Internet penetration has been further driven by the COVID-19 pandemic, which has changed people's behavior to reduce physical contact with other people but still requires them to carry out daily activities online through various digital platforms (BPS, 2021).

The rapid development of technology in Indonesia has become an interesting phenomenon in this decade. However, this condition has become a dilemma because there is no infrastructure support where Indonesia cannot face technological progress, which has become a dilemma of increasing or slowing down where these technological changes have not been supported by proper digitalization infrastructure (Lutz, 2019). This has led to inclusive technological growth, resulting in a widening digital divide. It calculated digital inequality based on the Information and Communication-Technology Development Index (ICT-DI) developed by the International Telecommunication Union (ITU) under the ICT Development Index (ICT-DI). ICT-DI is very important as a standard measure of the level of ICT development in a region that can be compared between time periods and regions (Hargittai & Hinnant, 2008). In addition, ICT-DI can also measure the growth of ICT development, digital gaps between regions, and the potential for ICT development (Indonesian Central Bureau of Statistics, 2020). The technological gap in Indonesia is relatively large compared to other countries in the world. They ranked Indonesia 72nd among the 110 countries.

Despite experiencing improvements, infrastructure support remains a problem because it has not been supported by adequate technological infrastructure. One example of beneficial Internet use is related to e-government as the use of technology to improve access to and provision of government services that benefit citizens (Silcock, 2001). The increase in technological infrastructure is inseparable from the allocation of government funds specifically for government spending on infrastructure. The Indonesian government should concentrate its efforts on a few areas in the upcoming years to address various issues and enhance the welfare of its people. Based on Figure 1, government spending on infrastructure during the 2016-2020 period experienced fluctuating movements, but overall, it experienced an increase in infrastructure expenditure of IDR 463 trillion, with the lowest being in 2017, which amounted to IDR 406 trillion.

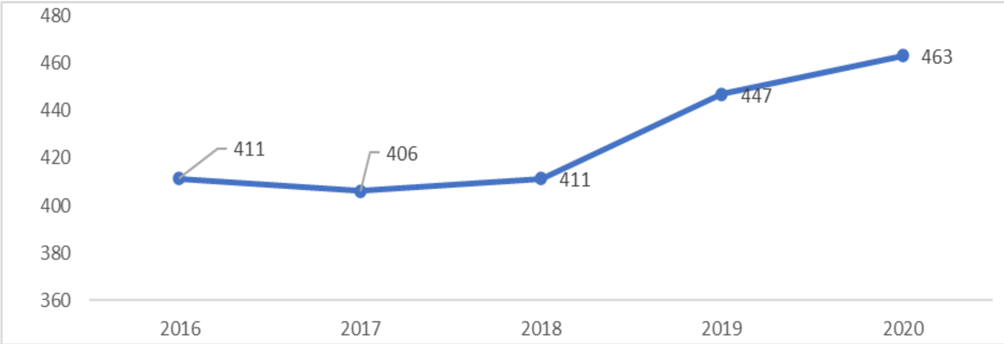

Figure 1. The development of government spending on infrastructure in Indonesia in 2016-2020

The relationship between government size in infrastructure and digital tensions reviewed by the latest study researched by Islam and Inan (2021), which found that there was a positive and significant relationship to the decline in digital interest. According to Leguina and Downey (2021), found that infrastructure improvements will reduce digital inequality in low-income countries. De Marco (2021) finds the importance of educational and online resources, as well as higher levels of digital skills, in increasing the possibilities for using the Internet for analysis with public administrations and government agencies. Ebbers, Jansen, and van Deursen (2016) found that digital skills do not predict or relate to satisfaction levels. The more digitally skilled citizens are, the more satisfied they are with the online services. Digital skills have become less relevant, this may mean that, in the long run, many citizens will continue to use e-government.

Based on the arguments, this study related to government size and digital inequality at the national level shows that each region has different characteristics that require development policies (Antonietti, Burlina, & Rodriguez-Pose, 2025; Kartiasih, Djalal Nachrowi, Wisana, & Handayani, 2023). Thus, by looking to hide the factors that influence the relationship between government infrastructure, gross domestic product, and digital inequality, the results are expected to assist the government and related parties in making policies and creating improvements in developing ICTs, and are also expected to be a reference for government considerations in strategic policies relating to infrastructure spending and issues of the technology change strategy.

Indonesia has made significant strides in digital technology adoption, there remains a substantial gap in addressing the necessary infrastructure to support these advancements, especially in underserved regions. The current literature has primarily focused on the growth of ICT usage and its potential, yet there is limited research on how government spending on infrastructure, specifically digital infrastructure, can address the widening digital divide (Heeks, 2021; Sutrisno, 2019). Furthermore, there is a lack of comprehensive analysis on how the government's infrastructure development efforts can be better aligned with technological advancements to ensure inclusive growth and reduce digital inequality.

2. Literature Review

2.1 Government Size

A government's scope and scale of operations are referred to as its size, and they can be quantified in several ways. Government size can be measured through various indicators, each reflecting the level of government involvement in the economy and society. Government expenditure refers to the total money spent on commodities, services, infrastructure, and social programs, often expressed as a % age of GDP, with larger governments generally spending more. Government employment, which includes public sector workers, military personnel, and civil servants, also signals government size, as a higher number of personnel usually correlates with a larger government. The burden of regulations measures the extent of rules imposed on individuals and businesses, with more regulations often indicating a larger government presence. Additionally, taxes levied by the government are a key factor in determining government size, as higher tax rates reflect greater government participation in the economy. Lastly, public ownership, which refers to the government's ownership or control over businesses and assets, is another indicator, with more state-owned enterprises signifying a larger government footprint in the economy.

2.2 Wagner Law
The general definition of Wagner's law shows that industrialization, urbanization, and increasing population density will lead to an increase in public spending as a share of GDP because of the increasing need for public facilities such as housing, hospitals, and other infrastructure (Buracom, 2016). The public expenditure growth model introduced by Wagner (1958) offers three reasons to support this hypothesis. First, as countries developed, their legal and communication relations grew more complex, resulting in a very large division of labor, which increased with industrialization (Cole, Elliott, & Zhang, 2009). Therefore, the state needs to increase its role in public, regulatory, and protective activities. In addition, increased urbanization and population density will lead to more public spending on law, order, and economic regulation because of the associated risk of more conflict in densely populated urban communities (Lamartina & Zaghini, 2011). According to Henrekson (1988), Wagner's contribution to theories significantly contributed to the prevailing view that when a country gets richer, government activities would decrease. Wagner's approach can be considered very important because it provides an opportunity to examine the interrelationships between economic and demographic factors that influence public policies, particularly health policies, both from time to time and between provinces.

H_1: Government size infrastructure to inequality digital

H_2: Optimizing infrastructure expenditure inequality digital

2.3 The Digital Gap
The definition of the digital divide and research strategies have evolved over time in an attempt to explain the root causes behind digital inequality. The first approach measures policymakers' level of convenient access. Once the level of access across age groups is considered to be causing divisions in digital advantages, expanding broadband coverage will be sufficient to close the gap (Cigna, 2018).

2.4 Keynesian Theory
According to the Keynesian perspective, the rate of economic growth varies with aggregate demand as a prerequisite for growth, and their analysis concludes that aggregate demand policies can improve economic performance (Holt & Pressman, 2001; Jahan, Mahmud, & Papageorgiou, 2014). Keynes categorizes government spending as an exogenous variable that can generate economic growth rather than an endogenous phenomenon. The government's role is very important because it can avoid depression by increasing aggregate demand and reviving the economy with a multiplier effect. According to Badulescu, Simut, Badulescu, and Badulescu (2019), Keynes categorizes government spending as an exogenous variable that can generate economic growth, not an endogenous phenomenon. The government's role is very important because it can avoid depression by increasing aggregate demand and reviving the economy with a multiplier effect. According to Badulescu et al. (2019), government spending can help increase the level of productive investment to guarantee economic growth and development. Thus, spending has a positive effect on economic growth.

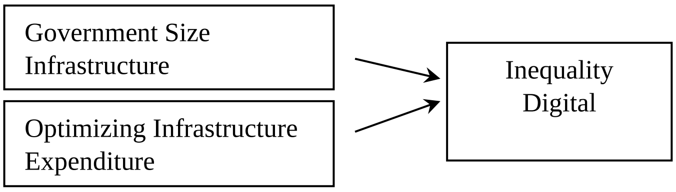

Figure 2. Conceptual model

Figure 2 presents a conceptual model showing that Government Size Infrastructure and Optimizing Infrastructure Expenditure influence Digital Inequality. This indicates that the government's role in infrastructure provision and the effectiveness of infrastructure spending are important factors in shaping the level of digital inequality.

3. Research Methodology

This study examines the relationship between sector government expenditures, infrastructure, gross domestic product, and the Technology and Communication Development Index. The type of data used is quantitative data, namely data as numbers and symbols or statistics, either extracted directly or obtained through the processing of qualitative data into quantitative data (Arifianto, 2011). The data collection method used in this study was to collect and study secondary data (Arifianto, 2011). In this research, they collected observed data, including government spending on infrastructure, gross domestic product, and the Information and Communication Technology Development Index (IP-TIK) during the 2016–2020 period in 34 provinces in Indonesia.

Table 1. Data and sources

Variable	Description	Source
Government Infrastructure	Expenditure allocated to % infrastructure	Ministry of Finance
PDB	Gross Domestic Product per % capita	Indonesia Central Bureau of Statistic
Digital Inequality	Information Technology % Development Index.	International Telecommunication Union

Table 1 show the data analysis in this study used two analytical methods descriptive analysis and quantitative analysis. Descriptive analysis was used to examine the development of infrastructure, gross domestic product, and Information and Communication Technology Development Index (IP-TIK). They used descriptive analysis to explain the existing data in graphs and tables. The government size calculation compares infrastructure spending with the digital divide using mapping and a typology based on the area analyzed. The analysis used to analyze the influence of government size on the digital divide was conducted quantitatively. The analytical tool used was panel data regression using the Ordinary Least Squares (OLS) method. In general, an analytical model is formulated using the following mathematical equations:

$$TI_{iT} = \beta_0 + \beta_1 GI/PDB_{it} + \beta_2 GI/PDB^2{}_{it} + e_{it} \quad (1)$$

The symbols in the Formula 1 can be described as follows:

1. TI_{iT} TI_{iT} = Digital Divide
2. β_0 β_0 = Intercept
3. GI/PDB_{it} GI/PDB_{it} = Infrastructure spending to GDP ratio
4. $GI/PDB^2 GI/PDB^2$ = Optimization Effect
5. $\beta_1 - \beta_2 \beta_1 - \beta_2$ = Independent variable regression coefficient
6. $e_{it} e_{it}$= *Error term*

4. Result and Discussion

4.1 Result Analysis

Field findings show that the COVID-19 pandemic in 2020 significantly changed various aspects of life worldwide, particularly in the use of Information and Communication Technology (ICT). Before the pandemic, people generally carried out activities and social interactions directly. However, the pandemic forced society to reduce physical contact and shift many activities to digital platforms. Based on the estimated results of internet activity, the number of active mobile broadband subscribers per 100 inhabitants increased to 104.00 in 2020. Similarly, fixed broadband subscriptions per 100 inhabitants also increased, reaching 3.96 in the same year.

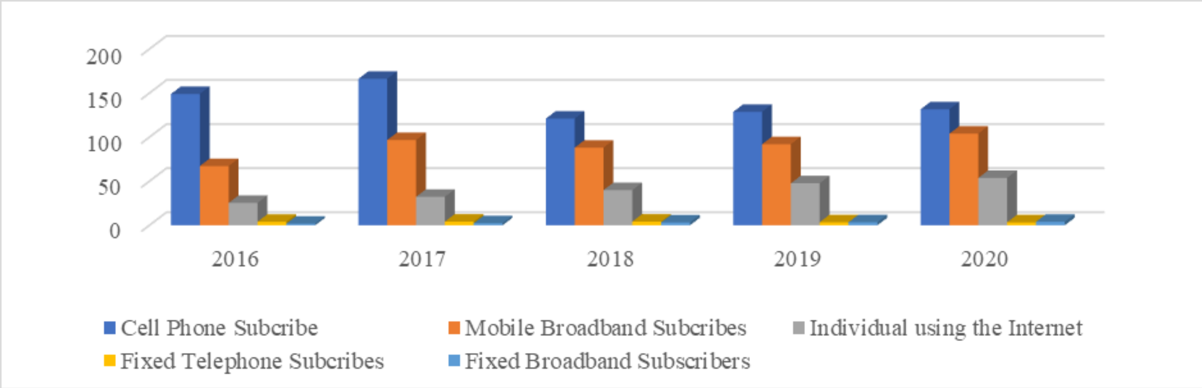

Figure 3. ICT development in Indonesia 2016-2020

Figure 3 illustrates Indonesia’s ICT development from 2016 to 2020, highlighting that mobile-based communication, particularly cell phone and mobile broadband subscriptions, drove growth while fixed-line services remained low. Internet penetration increased from 25.37% to 53.73%, accelerated by the COVID-19 pandemic which shifted daily activities online, revealing both expanded digital access and persistent challenges such as digital inequality, limited digital literacy, and low digital skills, especially among rural, elderly, and economically disadvantaged populations.

The digital divide has a broad impact, especially the problem of digital transformation in the health sector: (1) primary and secondary health services as well as health data that are difficult for health workers to access; (2) the completeness, consistency, and accuracy of health data do not meet the standards for making *evidence-based policies;* (3) health data interoperability; and (4) overlapping data due to too many applications, resulting in the inefficient and ineffective recording of health data. Digital infrastructure problems in the economic sector, especially the reach of Internet connectivity and the level of digitization of MSMEs included in e-commerce applications in Indonesia, are still low. In addition, there are challenges related to cybersecurity guarantees, especially low digital trust and slow digital economic growth.

The development of economic growth, as seen from income per capita purchasing power parity from 2015 to 2020, shows a yearly trend of fluctuations. The per capita income growth during the study period reached an average of 5.1%. The main factor driving Indonesia's economic growth is domestic demand, particularly household consumption, investment, and government consumption. However, in the last five years, economic growth has been seen to have slowed and is in a relatively low category.

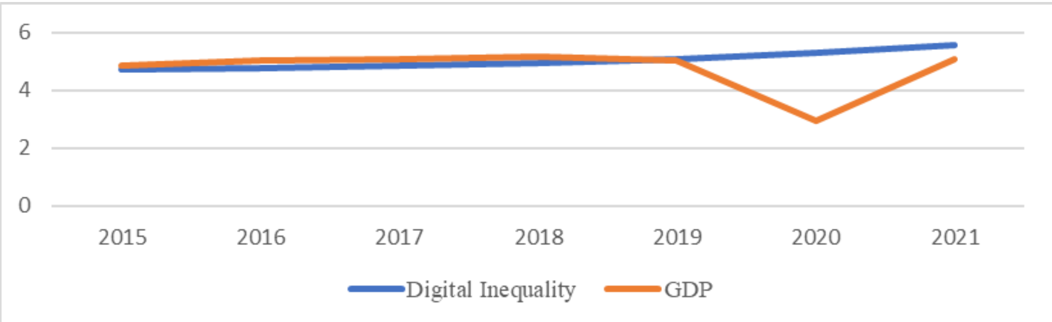

Figure 4. Digital inequality and economic growth in Indonesia

Figure 4 indicates that Indonesia’s ICT index increased from 2015 to 2020, reaching its highest point of 5.59% in 2020, largely driven by the skill sub-index. Despite this rise, digital inequality remained high, averaging 5.31%, reflecting persistent gaps across public services, health, education, and the economy. Infrastructure spending accounted for only 23% of total government expenditure during this period, with notable regional disparities: eastern Indonesia received below-average allocations, Java had a low absorption rate at 19.45% due to delayed implementation of housing and public facilities projects, while Sumatra achieved the highest ratio thanks to provincial policies prioritizing infrastructure development.

4.2 Model Estimation Results

Based on the estimation results from the Government Size Infrastructure and Digital Inequality model through CEM, FEM, and REM, which are presented in the table below, regarding the use of these methods, the *Common Effect Model* Variable Government Infrastructure Size (GI) and Government Infrastructure Size (GI2) show that they do not have significance in the ICT Index. Using the Fixed Effect Model, the estimation results show that the Government Size Infrastructure (GI) variable has a significant impact on the ICT index. Infrastructure Government Size (GI2). The probability value of this variable was less than the significance level of = 5% (0.05) for national competitiveness. Using the Random Effect Model, the Government Size Infrastructure (GI) variable does not have a significant impact on the ICT Index, while government size infrastructure (GI2) shows that it has a significant impact on the ICT Index.

Table 2. Estimation results Common Effect Model (CEM), Fixed Effect Model (FEM) and Random Effect Model (REM)

Variables	Common		Fixed		Random	
	Coefficient	Probe.	Coefficient	Probe.	Coefficient	Probe.
C	0.0000	0.0000	4.170427	0.0000	4.090734	0.0000
GI	0.9133	0.9133	-0.729935	0.0016	-0.674670	0.0610
GI2	0.7640	0.7640	0.527610	0.0000	0.512431	0.0075

Table 2 shows the results indicate a non-linear relationship, where GI has a negative effect while GI2 has a positive and significant effect, suggesting that the influence of GI may turn positive after reaching a certain level. The final model selection effort is used to determine the regression model to be used in the evaluation of the best model among the common effect model, fixed effect model, and random effect. Model using three estimation techniques. They used these three techniques in panel data regression to obtain the correct model for estimating panel data regression. The first three tests are the test Chow, test Hausman, and Lagrange multiplier.

Table 3. Model testing results

No	Testing	Statistic	Probabilitie s
1	Uji Chow	37.62	0,0000
2	Uji Hausman	10.00	0,0000
3	UJI LM	163,6	0,0000

Based on the Table 3, the results of the Chow test show that the probability value cross-section Chi-Square = 0.0000 > 0.05 This shows that H_a is accepted because the probability value is less than 0.05. Based on the Chow Test, the best model for use is the fixed-effect model. The Hausman test results showed a random cross-section value of 0.000 < 0.05. This shows that H_0 was rejected and H_a was accepted because the probability value was less than 0.05. Based on the results obtained with the Hausman test, it can be stated that the best model is the Fixed Effect Model (FEM).

After testing the suitability of the model for panel data regression using the Common Effect Model (CEM), Fixed Effect Model (FEM), and Random Effect (RE), the method that is best used according to the testing of the three models is the FEM. Because of testing using the Chow Test and Hausman Test, which both obtained the best model results for the FEM, the LM test was no longer used. In this model, all variables are declared significant; therefore, based on statistical testing, the model uses a FEM.

Table 4. Panel data regression estimation results

Variables	Coefficient	Std. Error	t-Statistic	Probe.
C	4.170427	0.131922	31.61292	0.0000
GI	-0.729935	0.225263	-3.240375	0.0016
GI2	0.527610	0.097887	5.389988	0.0000
R-squared	0.959373			
Adjusted R-squared	0.945153			
S.E. of regression	0.246879			
F-statistic	67.46879			
Probe (F-statistic)	0.0000			

Table 4 shows the regression equation shows a constant value of 4.170427, which is positive. That is, if the variables government size infrastructure and optimization of infrastructure spending are considered zero, then the ICT Index is 4.17. That is, the ICT Index without government-sized infrastructure and the Effect of Optimizing Infrastructure Spending are 4.17. The coefficient value (β1) = -0.72993 can be interpreted as the variable Effect of Optimizing Infrastructure Expenditure having a negative effect on the ICT Index. If there is a 1% increase in government-sized infrastructure expenditure, then the index will decrease by 0.7293. Furthermore, the coefficient value (β2) = 0.527.610 can be interpreted as indicating that the variable Effect of Optimizing Infrastructure Spending has a positive effect on the ICT Index, if there is a government-sized infrastructure of 1%, it will increase the ICT Index by 0.527610 %.

4.3 Statistical Test Results

4.3.1 F-test

The results of the F statistic test show that the probability value of the F statistic is smaller than the significance level of 5% (0.0002 < 0.05). Therefore, the variable government infrastructure size and the effect of optimizing infrastructure spending have a significant effect on the ICT Index.

4.3.2 T-test

The probability value of the Government Size Infrastructure variable is smaller than the significance level of 5% (0.0000 < 0.05), so partial Government Infrastructure Size has a significant effect on the ICT Index. The variable probability of government infrastructure size is smaller than the 5% significance level (0.0016 < 0.05), so it partially has a significant effect on the ICT Index. The variable in the Effect of Optimizing Infrastructure Expenditure has a probability value smaller than the 5% significance level (0.0000 < 0.05), thus, the sector in the Effect of Optimizing Infrastructure Expenditure has a significant effect on the ICT Index.

4.3.3 R^2 Determination Test

The next test tests the coefficient of determination to determine how much variation the variable has in government infrastructure size and the effect of optimizing infrastructure spending. In determining the variation of the ICT Index variable with the results of R^2 equal to 0.959 or 95.9%, the variation of these variables determines the variation of the ICT Index. The remaining 14.1% were influenced by variables outside the research model.

4.4 Discussion

Based on the estimation results, the threshold calculation can be performed for government *size* by The value of the first difference in government size is calculated from the model equation, according to the following formula:

$$\frac{\partial TIK}{\partial GOVERMENT\ SIZE} = \beta_1 + 2\beta_2\ Goverment\ Size \ = 0 \tag{2}$$

$$Goverment\ Size = \frac{-\beta_1}{2\beta_2}$$

Based on Formula 2, the average government size threshold for Indonesian provinces was 68%. This value is far greater than the government size threshold, which is calculated using data per province in the United States at 11.42% Vedder and Gallaway (1998) and Italy at 52% (Di Liddo, Magazzino, & Porcelli, 2018).

The results suggest that local government spending in Indonesia may create a threshold effect, where government size reaches around 68%, largely driven by transfer funds allocated to regional governments. Barro (1990) states that increased spending with a source of funding from tax revenues will initially increase economic growth. However, when taxes are too high, additional spending will reduce economic growth (Buhtz, Reinartz, König, Graf-Vlachy, & Mammen, 2016). Because most local governments do not use taxes from their own regions to finance spending in these regions, the negative effect of taxes on economic growth is smaller. Thus, the threshold for government size resulting from the model is higher.

Based on the statistical results, the potential of government infrastructure spending to improve the ICT index can be seen from the positive coefficient of the optimizing effect of infrastructure expenditure, while government size in infrastructure spending shows a negative effect that may reduce the ICT index. However, the findings also indicate that the ICT index can increase through the multiplier effect of infrastructure spending, suggesting that digital equality can be achieved by increasing infrastructure budget allocations focused on technology provision, server development, and digital competence improvement. These results also consider how the implementation of the infrastructure budget supports digital equity (Lissitsa, 2015). In particular, if the government focuses on strengthening the digital infrastructure from a budgetary perspective, there will be a multiplier effect in the technology development sector. Currently, the demand for technology is very high but not evenly distributed, so it is necessary to have an equal distribution of infrastructure in all corners to proportionally increase the allocation of the infrastructure budget.

5. Conclusions

5.1 Conclusion

This study estimates the impact of government size on field infrastructure for digital inequality in Indonesia at the regional level using data for the period 2016–2020. In this study, government size is measured by the percentage age of total spending by ministries and agencies allocated through work units in each province, the realization of APBD spending in each province, and the realization of district or city APBD spending in each province against the GRDP. The estimation results show that government size has a negative and significant impact on the ICT index, while the squared or multiplier effect of infrastructure spending has a positive and significant impact on the ICT index. It can be concluded that when government size is still relatively small, the influence of government size on regional ICT indices in Indonesia is positive. However, when the government is too large, the effect becomes negative or nonlinear. The estimation results show that the average threshold government size for provinces in Indonesia was 68%. This value is far greater than the government size threshold, which is calculated using data per province and the results of research by, namely 52%.

5.2 Research Limitations

This study was confined to analyzing data at the national level for each region in Indonesia, focusing on regional trends and patterns without extending to a more granular level of analysis, such as provincial or district-specific data. This limitation restricts the ability to draw more localized conclusions that may offer deeper insights into regional disparities and variations within Indonesia's diverse geographic and socio-economic landscape.

5.3 *Suggestions and Directions for Future Research*

Future research could explore the long-term effects of infrastructure spending on regional economic growth, particularly focusing on how investments in digital infrastructure can bridge the gap between developed and underdeveloped areas. Additionally, investigating the impact of government spending on social equity and the quality of public services in different regions could offer deeper insights into the effectiveness of fiscal policies in achieving inclusive development. Future research could benefit from incorporating data at subnational levels to capture the nuanced differences between provinces and districts, providing a more comprehensive understanding of the regional dynamics.

Acknowledgements

The authors would like to express their gratitude to all participants and contributors who made this study possible. Special thanks are extended to the research team for their valuable input and dedication throughout the study process. The authors also appreciate the support of the institutions involved in the data collection and analysis.

Author Contributions

AY conceptualized the study, designed the research methodology, and conducted the data analysis. SS contributed to data collection, literature review, and interpretation of results. ZZ assisted with manuscript writing and provided critical revisions to the study. All authors reviewed and approved the final manuscript.

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