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DO REGIONAL MACROECONOMIC VARIABLES INFLUENCE THE INCOME INEQUALITY IN INDONESIA?[5]

This article examines the effects of government expenditures, regional GDP, regional minimum wages, employment rate, and poverty severity on income inequality by applying the system Generalized Method of Moments panel model to overcome the dynamic endogeneity problem from 2007 to 2020. The results show that government expenditure and an increase in the regional minimum wage for low-wage workers can reduce income inequality in both the short run and long run. Furthermore, high regional GDP and high levels of employment rate for workers with low skills can exacerbate the level of income inequality in the long run. However, reducing the severity of poverty has no effect on reducing inequality. This study provides policy recommendations to the government to improve basic public services and make various training skill programs, including ICT, in order to increase creativity and job opportunities for low-income people.
Keywords: income inequality; government expenditures; regional GDP; regional minimum wages; employment rate; poverty severity index
JEL: E01; E24; I30; H50; O15

1. Introduction

Economic inequality is one of the main issues that a country focuses on when determining its domestic policies, both in developed and developing countries (Statistics Indonesia, 2020). Income inequality in mostly nations around the world has experienced a significant increase over the last few years (Afandi, Rantung, Marashdeh, 2017; International Monetary

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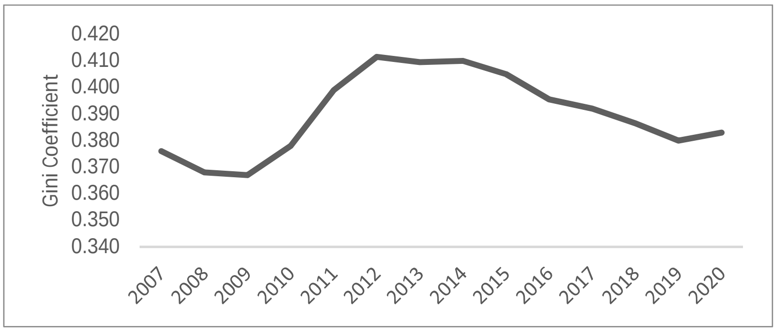
Fund, 2021). Income inequality leads to differences in the uneven equality of income and resources in society. In short, it means there is a gap between rich and poor people in a country (Shin, 2012). It is usually measured by the Gini coefficient based on the Lorenz curve and also the changes in the income sharing of the population (the decile ratio) by checking access to basic services and opportunities (Dabla-Norris et al., 2015; Mdingi, Ho, 2021).

Figure 1. Indonesia's Gini coefficient index (2007-2020)



Source: Statistics Indonesia (2021).

Indonesia, as a developing country, has experienced a fluctuating increase in income inequality as measured by the Gini coefficient index over the last few years (Figure 1). Income distribution between regions in Indonesia shows a pattern that varies between provinces, but in Indonesia, the Gini index has decreased from 2007 (0.376) to 2009 (0.367), where the average from that year shows the lowest inequality is in the Bangka Belitung Islands (0.280). From 2010 to 2012, the distribution of Indonesia's income was increasingly uneven, where the Gini coefficient increased sharply but continued to decline from 2014 to 2019 (0.380). Indonesia's highest Gini ratio during the analysis year was in 2012 at 0.412, and the widest income inequality was in the Papua Province at 0.443 and the DI Yogyakarta Province (0.442). In 2020 (0.383), the Gini coefficient again experienced a slight increase from the previous year caused by the Covid-19 pandemic impact, and the area with the highest Gini coefficient was still in the DI Yogyakarta Province (0.436), then Gorontalo (0.407). In the period of 2012 to 2015, the level of inequality in Indonesia showed the highest level. This means that the bigger the Gini coefficient, the more unequal the level of the income distribution (Gnangoin et al., 2019).

To reduce the extreme gap between high and low-income residents, the government utilizes fiscal policy instruments through the imposition of taxes, so that there is a relationship between fiscal policy, poverty, and income disparity, where the government provides transfer payments or public goods for low-income people (Madzinova, 2017; Wernerová, 2019; Malla, Pathranarakul, 2022). Fiscal policies that focus on increasing government spending can encourage Indonesia to break the cycle of intergenerational inequality (The World Bank and Australian Aid, 2015). The interaction of government spending in the public sector can also be measured through income distribution as measured by the Gini ratio (Pula, Xhelili, 2022).

Indonesian government expenditures from 2007 to 2019 continued to increase, but in 2020 government expenditures decreased because the government focused more on health spending, economic recovery, and social safety nets. In 2020, the use of the central government's budget structure was prioritized for taking care of the pandemic and its effects (The Ministry of Finance, 2020).

Several studies have been analyzed, including the determinants of inequality in terms of fiscal spending; for example, research conducted by Mello and Tiongson (2006) suggests that government redistributive spending is inefficient in reducing income inequality and poverty because the benefits of public spending are obtained by the non-poor due to government spending that is not on target (Ramos, 2000). Government expenditure through village funds in Indonesia can reduce some income inequality, although the effect is not very significant because village fund policies are not structured for pro-equality (Ernawati, Tajuddin, Nur, 2021). However, research conducted by Martínez-Vázquez, Vulovic and Moreno-Dodson (2012) in 150 countries (developed, developing, and transitional) between the period 1970-2006 using the GMM panel model stated that government redistribution spending, especially spending in the social sector (social protection, education, health, and housing) has an influence on reducing income disparity.

A high increase in income inequality will also affect economic growth; when the total income of the richest people increases by five percentage points from 20 percent, it will reduce economic growth by 0.4 points. Conversely, if the income of the poorest people increases by five percentage points, economic growth will increase by 1.9 points (The World Bank and Australian Aid, 2015). One of the important parameters in understanding the state of a country in a certain period is to look at the value of Gross Domestic Product (GDP), both based on constant prices and current prices. Constant price GDP is used to specify economic growth from year to year (Statistics Indonesia, 2022; Kholifia et al., 2021). The variable used in this study is a gross regional domestic product at constant prices measured in rupiah to see its effect on income inequality, while other studies use real GDP growth rate per capita (Bagchi, Svejnar, 2015; Agusalim, Pohan, 2018; Royuela, Veneri, Ramos, 2018; Breunig, Majeed, 2019), GDP per capita measured at constant prices in US dollars by Batuo, Kararach and Malki (2022), and GDP per capita as measured in percentage (Carrera, Rombaldoni, Pozzi, 2021).

Gross Regional Domestic Product (GRDP) of Industrial Origin at constant prices continued to increase from 2007 to 2019, but then decreased in 2020 due to the Coronavirus pandemic. In terms of the total GDP of Indonesia in 2020, there was not a significant decrease when compared to neighbouring countries. According to World Bank data, Indonesia's total GDP of 1.058 trillion USD is still above Singapore (340 billion USD) and Malaysia (336.7 billion USD) (The World Bank, 2022).

Another effective instrument in reducing income inequality is the minimum wage policy to increase the income of low-wage workers (Sotomayor, 2021; Pantea, 2020; Lin, Yun, 2016; Maia, Sakamoto, Wang, 2019). Nevertheless, it is worrying that an addition to the minimum wage can diminish employment, especially in developing countries that rely on low labour costs for the purpose of competitiveness (Pantea, 2020). In Indonesia, for example, the minimum wage, which almost doubled from 2012 to 2020, led to a decrease in income disparity. The minimum wage is the minimum amount of remuneration or the lowest monthly wage that must be paid by employers to wage recipients/employees/labourers in work carried out for a certain period of time and cannot be reduced by mutual agreement or individual contracts, including basic wages and fixed allowances. Meanwhile, the Regional Minimum Wage (RMW) is the minimum wage applicable in a specific province (International Labour Organization, 2014; Regulation of the Minister of Labour Republic Indonesia No. PER-01/MEN/1999; Statistics Indonesia, 2022). The average RWM Indonesia over the last 14 years continues to increase.

The role of minimum wage as a labour policy affects the supply in the labour market in Indonesia so that job opportunities will decrease. The employment rate is the percentage of the labour force over the age of 15 who are employed (Statistics Indonesia, 2022). Nowadays, the growth in income disparities is recognized as one of the foremost developments in employment relations and has been considered as an important tool for reducing inequality (Kochan and Riordan, 2016). Research conducted by Maia, Sakamoto and Wang (2019) in Brazil found that income inequality in Brazil is significantly higher than in developed countries such as the US, where Brazil faces lower economic development due to low education, wages, and work skills in its labour force. This challenge is also faced by Indonesia, where the poor and vulnerable groups are those who are employed in low-skilled jobs (Lindsay et al., 2015) and thus widen income disparities. The men of productive age who possess low skills are less likely to be employed than people who have high skills (Wolcott, 2020). Social support for an increment in the minimum wage is also an important policy in reducing poverty levels (Sotomayor, 2021).

Moreover, inequality is one of the issues often associated with poverty. There is a positive dynamic causality relationship between poverty and income disparity in both the long-term and short-term (Apergis, Dincer and Payne, 2011). Sen (1976) and Foster et al. (1984) state that disparity and poverty have a close relationship in which inequality is an element of poverty (Annim, Mariwah and Sebu, 2012). Inequality and poverty have a pragmatic relationship where inequality can exacerbate poverty levels because the disparity is a form of poverty (Barber, 2008). The increase in income inequality of the poor increases the poverty gap, thereby increasing income inequality (Hassan, Zaman, Gul, 2015). A good benchmark in calculating the poverty level includes three poverty parameters, that is: (a) the poor as measured by percentage, (b) the overall poverty gap, and (c) the distribution of income among the poor as seen from the poverty severity index (Kakwani, 2000).

The percentage of poor people below the poverty line is calculated roughly (Statistics Indonesia, 2021; Badrudin, 2017). This measure has the same weight, so that there is no difference between the very poor and the very rich among the poor. The effect is that the number and percentage of poor people has not been able to show how severe poverty is. Poverty severity assesses how poor the poor people actually are compared to other poor people. Thus, the poverty severity index is more sensitive in explaining the size of inequality among the poor; what this means is that the greater the value of the poverty severity index is, then the higher the distribution of income or expenditure among the poor (Panda, Rath, 2004 in Ofori-Boateng, 2016; Ravallion, Bidani, 1993). The Poverty Severity Index (P2) indicates the distribution of per capita expenditure among the poor that is not evenly distributed among the poor (Statistics Indonesia, 2021; Debebe, Zekarias, 2020). According to Statistics

Indonesia, the severity of poverty in Indonesia from 2007 (0.84) to 2014 (0.44) decreased every year, but in 2015 it increased (0.52) due to the poverty line in rural areas, which was IDR250,739; this was higher than urban areas, which was IDR243,059. Villagers usually buy goods that are distributed from the city at retail so that the price obtained by the village community becomes more expensive. The poverty severity index fell again in 2019 by 0.37 and increased again in 2020 by 0.43 due to the Covid-19 Pandemic. Although the severity of poverty in Indonesia fluctuates, the number is still relatively high, which is still above 0.3 points.

This article expands the previous research by connecting regional macroeconomic variables together. Therefore, this study aims to examine the influence of government expenditures, regional GDP, regional minimum wages, employment rate, and poverty severity on income inequality in Indonesia.

2. Data Description and Methodology

2.1 Data and description of variables

2.1.1 Data

Data was obtained from The Ministry of Finance and Statistics Indonesia. This study utilized secondary data in the form of time series from 2007 to 2020 and cross-section data which consisted of 33 provinces in Indonesia. The province of North Kalimantan was not included in the analysis because it only existed in 2012. This research can be categorized into polled data, a combination of time series, and cross-section data.

Table 1. Variable description

Variable	Definition/Measurement	Source
Gini Coefficient (GINI)	A measure of income inequality, the value ranges between 0 (perfect income distribution) and 1 (perfect inequality) (points)	Statistics Indonesia
Government Expenditure (GOVEXP)	Total expenditure at fiscal year (IDR)	The Ministry of Finance
Gross Regional Domestic Product (GRDP)	Gross regional domestic product at constant prices (IDR)	Statistics Indonesia
Regional Minimum Wage (RMW)	Minimum wage applicable to each province (IDR)	Statistics Indonesia
Employment Rate (ER)	The percentage of the labour force that works (%)	Statistics Indonesia
Poverty Severity Index (PSI)	A measure of the severity of poverty, the higher the index value, the more unequal the expenditure among the poor (points)	Statistics Indonesia

Source: Author's Compilations.

According to the previous literature, this analysis used six variables. Table 1 shows a list of variables used in this analysis. The dependent variable is the Gini coefficient, and the explanatory variables are government expenditures, regional gross domestic product, regional minimum wages, employment rate, and poverty severity index.

2.1.2 Descriptive Statistics Analysis

Descriptive statistical analysis is a form of data analysis that shows a number of observations that are very important for carrying out research. This type of analysis is based on the data that has been collected (Rashid, Bakar, Razak, 2016). The following analysis describes all variables used in this study.

Table 2. Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
GINI	462	0.35906	0.03773	0.25950	0.44250
LogGOVEXP	462	12.56409	0.43650	11.54259	13.81250
LogGRDP	462	13.97321	0.59548	12.35675	15.26393
LogRMW	462	6.12797	0.21184	5.65176	6.63107
ER	462	94.01158	2.48417	84.24563	98.60196
PSI	462	0.66365	0.68260	0.07000	5.66000

Note: T=14, N=33
Source: Calculation by the authors.

Table 2 shows that all variables have an observation range of 462. ER, or the level of employment rate, has the highest average value at 94.012 percent, with a standard deviation of 2.484 percent, a maximum value of 98.602 percent, and a minimum value of 84.246 percent. The large labour force causes a high level of employment rate. Furthermore, Income Inequality (GINI) obtained the lowest standard deviation of 0.0377 with a mean value of 0.3591, a maximum value of 0.4425, and a minimum value of 0.2595. Indonesian government expenditures (LogGOVEXP) average is 12.5641, with a standard deviation of 0.4365. The minimum score is 11.5426, while the maximum score is 13,8125. A standard deviation more minor than the mean value indicates a small gap between the most minor and enormous government expenditures. Based on the six variables studied, GINI, LogGOVEXP, LogGRDP, LogRMW, and ER show a standard deviation that is smaller than the mean value, which means that the distribution of the data variables is the smallest or there is not a large big enough gap between the lowest and the highest. The PSI shows an average of 0.6637, a maximum value of 5.6600, and a minimum value of 0.0700. This indicates that there is still a high disparity in spending among the poor, such as in the Provinces of West Papua and Papua, from 2007 to 2020.

2.2 Model

The effect of government spending, regional gross domestic product, regional minimum wage, level of employment, and the severity of poverty on income inequality can be analyzed using panel data which aims to minimize the bias that comes from the effect of testing the results of the regression. Furthermore, the panel data model estimation is carried out through two approaches, namely the Pooled Least Squared and the Fixed Effect Model.

Arellano and Bond (1991) recommend the panel Generalized Method of Moments (GMM) model, whose measurement is through dynamic effects, where the approach used is more efficient than the Anderson and Hsio (1982) estimator (Baltagi, 2005).

The dynamic panel method is used to show the correlation between parameters in a dynamic economy. This dynamic correlation is seen from its characteristics; namely, there is a lag of the dependent or dependent variable that is between the regressors or independent variables. Therefore, the dynamic data method is the right model to be used in analyzing the economy (Baltagi, 2005).

The dynamic panel data model can be written as (Ekananda, 2016; Baltagi, 2005)

$y_{it} = \gamma y_{it-1} + \beta' x_{it} + u_{it}$; *i=1,2,3,....., N; t = 1,2,3,……, T* (1)

where:

y_{it} is the unit of observation of the ith cross-section at time period *t*,

γ is a scalar or intercept coefficient,

x is a matrix of size 1 x *K,*

β is a matrix of size *K* x 1, and it is assumed that u_{it} is a one-way error component model, the equation is (Baltagi, 2005*;* Nabilah, Setiawan, 2016*;* Mileva, 2007):

$u_{it} = v_{it} + e_{it}$ (2)

where:

v_{it} is the effect of the unobserved region specification

e_{it} is the error term.

Ekananda (2016) said that the basis of a regression model assumption is that the dependent variable has a relationship with the residue even though the regressor is not allowed to have a correlation with the residue. Equation 1 shows that there are lagged dependent variables that have a relationship with the residue. Therefore, testing with OLS is inconsistent and to replace the lag of the dependent variable, the instrument variable is used. The GMM model overcomes the problem of the relationship between lagged dependent variables and residuals by using a variable instrument.

Testing using the GMM dynamic panel model in this study considers several basic aspects, that is: 1) The GMM Panel Model is able to handle endogeneity associated with the use of lag in the dependent variable. 2) The GMM panel approach is designed for data that has small or short T-time series data but large or N-many cross-sections. 3) The emergence of the dependent variable lag (dependent) variable y_{it-1} will cause autocorrelation. Therefore, the GMM dynamic panel includes the instrument variable with the dependent variable in the previous year. 4) Characteristics of an area that is time-invariant, such as in terms of geography and similar demographics (fixed effects), may be correlated with explanatory variables so that the fixed effects contained in the error term equation can be seen from equations 1 and 2 above. This problem can be overcome by transforming the regressor into the first difference (Mileva, 2007).

The influence of government expenditures, gross regional domestic product, regional minimum wage, employment rate, and poverty severity on income inequality in Indonesia is formulated through the model developed by Arellano dan Bond (1991) and Blundell dan

Bond (1998) specification of the dynamic panel equation model Generalized Method of Moment (GMM) is as follows (Ekananda, 2016; Iskandar, 2021; Jia, Guo and Zhang, 2014; Ullah, Akhtar and Zaefarian, 2018; Pantea, 2020):

$$GINI_{it} = \alpha + \beta_1 LogGOVEXP_{it} + \beta_2 LogGRDP_{it} + \beta_3 LogRMW_{it} + \beta_4 ER_{it} + \beta_5 PSI_{it} + \beta_6 GINI_{it-1} + \varepsilon_{it} \quad (3)$$

GINI is income inequality as measured by the Gini coefficient Index, LogGOVEXP is total government spending, LogGRDP is Gross Regional Domestic Product, LogRMW represents the regional minimum wage, ER is the level of employment rate, and PSI is the Poverty Severity Index. β_j (where $j=1,2,...6$) is the parameter to be estimated, i is the cross-section ($i=1,2,3,\ldots, N$); t is time t is time series ($t = 1,2,3,\ldots, T$); ε_{it} is error term; $GINI_{it-1}$ represents one lag (lag to t) of the dependent variable income inequality in the previous year's performance (*t-1*), which is this lag included as an explanatory variable in the GMM estimation used.

The instrument variable in equation 3 is the lag contained in the endogenous variable in the form of income inequality and the exogenous variable in the model as independent variables (Iskandar, 2021).

The development of a model in which the use of the lag of the dependent variable in the regression as a regressor results in the emergence of endogeneity problems if it is estimated using a fixed-effects or random-effects approach, which results in bias estimation and does not occur consistently (Verbeek, 2004).

Two estimation processes are commonly used in the context of GMM to overcome existing problems, that is (Firdaus, 2020):

1. The approach from Arellano-Bond (1991) is called First-Difference GMM (FD-GMM).

$|\alpha|$ $y_{it} = \alpha y_{it,t-1} + \eta_i + v_i$ for example, if an autoregressive equation appears and one time difference or AR (1) is accompanied by unobserved individual-specific effects, it is <1.

$E[v_{it}] = 0, E[\eta_i] = 0, E[v_{it}\eta_i] = 0$ where *i* =1,..., N; *t* =2,…,T and $\eta_i + v_{it=} u_{it}$ it has the following standard error component composition:

where *i* = 1,..., N and *t* = 2,…,T

we can assume unrelated/correlated transient errors over time.

$E[v_{it}v_{is}] = 0$ where *i* =1,..., N and $s \neq t$

And the initial condition y_{i1} is predetermined

$E[y_{i1}v_t] = 0$ where *i* =1,..., N and *t* = 2,…,T

This assumption simultaneously implies the emergence of munculnya *m* = 0.5 (T-1) x (T-2) moment restrictions

$E[y_{i,t-s}\,\Delta v_t] = 0$ where *t* =3,…,T and $s \geq 2$

$E[Z_i \Delta v_i] = 0$ so it can be written as

Where Z_i is (T-2) x *m* matrix i.e.:

$$\begin{bmatrix} y_{i1} & 0 & 0 & \dots & 0 & \dots & 0 \\ 0 & y_{i1} & y_{i2} & \dots & 0 & \dots & 0 \\ . & . & . & \dots & . & . & . \\ 0 & 0 & 0 & \dots & y_{i1} & \dots & y_{i,T-2} \end{bmatrix}$$

And Δv_i is (T-2) vector $(\Delta v_{i3}, \Delta v_{i4}, \dots, \Delta v_{iT})$. This is the GMM condition, which is the dependent variable lag since *t*-2, and is called FD-GMM. This approach will create an estimator that has a consistency of if $N \rightarrow \infty$ at a relatively low or small *T*.

Limitations in the FD-GMM estimator will appear, causing the instrument to form a correlation/relationship between the lagged through the first differences, resulting in a weak instrument used (Blundell and Bond, 1998). The FD-GMM estimator will be more downward biased than the fixed effect, especially if the sum of the periods is limited. Therefore, the FD-GMM can be repaired if there is a use of the present value of lag that comes from the regressor as the instrument.

The weakness of the FD-GMM can be found by comparing the coefficients of the lagged variables obtained from the pooled least square, fixed effect, and FD-GMM model approaches. The model from panel data uses AR(1); if it is estimated through the pooled least square method, it creates an upward bias coefficient. However, if it is estimated through the within-group or fixed effect technique, it will create a downward bias coefficient. Therefore, the consistency of the coefficients can be accepted if the value is between the two.

2. The latest approach from Blundell and Bond (1998) is called System GMM (Sys-GMM)

The initial idea of system GMM is to estimate a system of equations derived from the first differences and at the level, using the instrument from the first differences. Blundell and Bond (1998) add several assumptions in estimating system GMM as follows:

$E(\eta_i \Delta y_{i2}) = 0$ for *I* =1,…, *N*

The above equation will occur if the mean of y_{it} is constant in periods 1,2,…, *T* for every *i*. The calculation of the instrument matrix in the System GMM estimator is:

$$Z_i^* = \begin{bmatrix} Z_i & 0 & 0 & \dots & 0 \\ 0 & \Delta y_{i2} & 0 & \dots & 0 \\ 0 & 0 & \Delta y_{i3} & \dots & 0 \\ . & . & . & \dots & . \\ 0 & 0 & 0 & \dots & \Delta y_{i,T-1} \end{bmatrix}$$

The moment conditions of the second degree of bias are described as follows:

$$E(Z_i^* u_i^*) = 0$$

Which is $u_i^* = (\Delta v_{i3}, \dots, \Delta v_{iT}, u_{i3}, \dots, u_{iT})$

That way, the system GMM estimator can combine the first differences equation group at the value level as the instrument with a different group at the first differences equation level as the instrument. The validity of adding these instruments can be seen in the Sargan test for over-identifying instruments.

The benchmarks for obtaining the best GMM or dynamic model are as follows (Firdaus, 2020; Ullah, Akhtar, Zaefarian, 2018).

1. **Consistent;** The consistent characteristic of the estimator will be able to be tested through the Arellano-Bond m_1 and m_2 statistical tests, and some software can automatically calculate it. The consistency of the estimator is obtained if the m_1 statistical test results in rejecting the null hypothesis and the results from the m_2 statistic state that the null hypothesis is accepted or the null hypothesis cannot be rejected.
2. **Valid Instruments;** Validity check using the Sargan test. The instrument is said to be valid if the Sargan test shows that it cannot reject the null hypothesis (accept the null hypothesis). If the null hypothesis is rejected, the researcher must reconsider the model or instrument used in the study.
3. **Unbiased;** The pooled least squares estimator has a biased upwards character, and the fixed effect has a biased downward character. The estimator is said to be unbiased between the two estimators.

3. Estimation Results and Discussion

3.1 Estimation techniques

This study uses static and dynamic models to achieve research objectives systematically. The GMM Panel estimation approach uses short panel data from 33 provinces (N) for 14 years (T) because of N > T. The function of the GMM method is as resilience between one another in observing the consistency of the relationship between observed parameters (Adeleye et al., 2020).

The static model is in the form of Pooled Ordinary Least Squares (POLS), where this model does not allow heterogeneity in all panel data, while the Fixed Effect (FE) model in the System Generalized Method of Moments (Sys-GMM) panel data can recognize heterogeneity. The Sys- GMM estimator was made to analyze panel data in the short run with the assumption that the process is dynamic, i.e., the current realization of the dependent variable is influenced by the previous realization apart from the fact that the regression is also not entirely exogenous and may be correlated with past realizations and may also the current time of the error term (Adeleye et al., 2020).

The procedure to show how the Sys-GMM Panel estimate is stronger than Pooled Least Square (PLS) is to estimate using panel data with Ordinary Least Square (OLS) and fixed effects. It can be started by analyzing OLS first and identifying the endogeneity problems that occur, followed by using fixed effects. The next step will be to show that the fixed effect cannot overcome the dynamic endogeneity problem. The GMM Panel model then includes the lagged value of the dependent variable (i.e., the variable from the previous year). Therefore, the problem of endogeneity can be resolved through a valid estimate from a very strict GMM process (Ullah, Akhtar, Zaefarian, 2018).

3.2 Estimations and Discussion

This study uses static and dynamic models to achieve research objectives systematically. Estimation of the analysis carried out started using the POLS method and then continued using the FE, FD-GMM, and Sys-GMM methods (Table 3).

Table 3. Static and dynamic model results

Variable	Static Models		Dynamic Models			
	POLS (1)	FE (2)	POLS (3)	FE (4)	*FD-GMM (5)*	*Sys-GMM (6)*
LogGOVEXP	-0.002496 (0.8056)	0.021529 (0.0364) **	-0.020429 (0.0003) ***	0.004912 (0.6267)	0.0147924 (0.445)	-0.0298024 (0.043)**
LogGRDP	0.027430 (0.0001) ***	0.055198 (0.0000) ***	0.020356 (0.0000) ***	0.051794 (0.0000) ***	0.0552912 (0.000)***	0.0520562 (0.000)***
LogRMW	-0.014118 (0.1609)	-0.087160 (0.0000) ***	-0.010913 (0.0444) **	-0.071622 (0.0000) ***	-0.0864336 (0.000)***	-0.0403222 (0.004)***
ER	0.002124 (0.0023) ***	0.001974 (0.0343) **	0.000378 (0.3339)	0.001217 (0.1170)	0.0013176 (0.310)	0.0020557 (0.090)***
PSI	0.017683 (0.0000) ***	-0.002033 (0.6174)	0.006703 (0.0001) ***	0.000853 (0.8286)	-2.42e-06 (1.000)	0.001883 (0.681)
GINI(-1)			0.857504 (0.0000) ***	0.523438 (0.0000) ***	0.4663482 (0.000)***	0.5718994 (0.000)***
C	-0.117745 (0.1495)	-0.332898 (0.0000) ***	0.050929 (0.2917)	-0.290813 (0.0003) ***	-0.3615562 (0.001)***	-0.146515 (0.059)*
R-squared	0.164947	0.760661	0.784418	0.857235		
Adjusted R-squared	0.155791	0.739775	0.781353	0.843324		
Durbin-Watson stat	0.277606	0.950982	2.070542	2.074204		
AR (1) AR (2)					0.0001 0.1505	0.0000 0.2065
Sargan test statistics					0.6977	0.2917
Observation	462	462	429	429	396	429
Instruments					84	96

*, **, *** Significant at the 10, 5 and 1 percent levels, respectively

Source: Authors' Computations.

3.2.1 Result of Pooled Ordinary Least Square and Fixed Effect

The approach with Pooled OLS Model does not pay attention to individual effects in cross-section and time-series data. Another approach assumption of the OLS model is that it is homogeneous between one group and another (Ullah, Akhtar and Zaefarian, 2018). The FE model has a different approach between the observed cross-sections so that heterogeneity appears between each group. The OLS and FE Panel models raise the issue of endogeneity (Verbeek, 2004).

The first estimate of the static POLS model shows that the GOVEXP and RMW coefficients are negative and insignificant to the GINI. Statistically, only the poverty severity coefficient shows a theoretically positive effect and is statistically significant in the sample, which indicates the percentage change in PSI increases the GINI by 0.0177. In summary, policies are needed to reduce the number of poor people.

The second estimate in the static FE model reveals a significant change in the PSI coefficient, which has a negative but significant effect. The RMW coefficient is the only variable by the theory, which shows a negative and significant effect on the GINI, which is 0.0872, where every percentage change in the regional minimum wage will cause a decrease in income inequality by 0.0872. This result implies that the implementation of regional minimum wages has an impact on low-income workers and is able to restore the distribution of wages to a very low level, thereby reducing the wage gap. The results of this study follow previous research (Sotomayor, 2021; Pantea, 2020; Lin, Yun, 2016).

The third and fourth estimates use a dynamic approach in the POLS and FE models, including the dependent lag component in the independent variable. The research analysis, although statistically significant, gave different results in the dynamic POLS and FE models, namely the POLS GINI coefficient (-1), which was 0.8575, which was greater than the FE GINI(-1), which was 0.5234. This difference becomes a serious problem in interpreting the results where the POLS results give biased results compared to FE.

3.2.2 Results of First-Difference GMM and System GMM

The test used in this analysis is the Panel Generalized Method of Moments (GMM). Table 3 shows the estimation results of FD-GMM and Sys-GMM dynamic panels.

Based on the previous explanation, the panel data model on income inequality is a dynamic model in which the lagged value is found in the dependent variable from the right side of equation 3. This theoretically can lead to a biased situation if it does not use the right analytical method (Anwar, 2018). The GMM model can overcome the problems caused by the dynamic state of the income inequality model. Table 3 shows several model specifications in order to obtain the best model and so that it describes the best results in the model.

The GMM model generally uses two types of estimates: The first difference is between GMM and system GMM. Before interpreting the estimated results of the GMM method, the first thing that needs to be done is to check the feasibility of the model. This test is carried out to obtain the best model criteria, for instance whether it is consistent, a valid instrument, and unbiased. The first estimate in measuring the feasibility of the model is by checking the consistency of the AR (1) and AR (2) values, or the p-value in the first and second-order correlations (Ullah, Akhtar and Zaefarian, 2018).The AR (1) test generally rejects the null hypothesis, but the main parameter is shown by the AR (2) value (Anwar, 2018). Table 3 shows the results of AR (2) on FD-GMM and Sys-GMM, obtaining p-values of 0.1505 and 0.2065, which means that they are not statistically significant at the 10 percent level. These results show that the consistency requirements are met where the coefficient estimation is consistent. The Arellano-Bond test is used to test for the absence of autocorrelation (no serial correlation) if under the null hypothesis where the error terms from two different periods are not correlated (Ullah, Akhtar, Zaefarian, 2018).

The second estimation of the feasibility of the model is testing the validity of the instrument used in the model using the Sargan test. The results of the Sargan test in the FD-GMM show that the p-value is 0.6977, and the Sys-GMM model is 0.2917, which means it is not statistically significant at the 10 percent level and accepts the null hypothesis, so it can be concluded that the instruments used in both models are valid.

The third test of the dynamic model obtains an unbiased estimate. The estimator is said to meet the unusual condition if the GINI Lag is between the POLS and FE estimators. A fair assumption can be realized because the estimated value of the GINI lag variable coefficient in the Sys-GMM model, which is 0.5719, is between the Pooled Least Squares estimator, which has a biased upwards character of 0.8575, and the Fixed Effect model which has a biased downwards character of 0.5234. On the other hand, the FD-GMM model does not meet the requirements because the value obtained is 0.4663, which is below the two estimators (Firdaus, 2020; Ullah, Akhtar, Zaefarian, 2018), so the dynamic panel model with the Sys-GMM approach is the best statistically because it has met the criteria for consistency, instrument validity and is unbiased.

Table 4. Results of the system GMM panel model in the short run and long run

Variable	*Sys-GMM*	
	Short-run	*Long-run*
LogGOVEXP	-0.0298024 (0.043)**	-0.0696154 (0.070)*
LogGRDP	0.0520562 (0.000)***	0.1215981 (0.000)***
LogRMW	-0.0403222 (0.004)***	-0.0941887 (0.001)***
ER	0.0020557 (0.090)*	0.004802 (0.090)*
PSI	0.001883 (0.681)	0.0043986 (0.686)
GINI(-1)	0.5718994 (0.000)***	
C	-0.146515 (0.059)*	

*, **, *** Significant at the 10, 5 and 1 percent levels, respectively

Source: Authors' Computations.

The use of the GMM dynamic panel model has its advantages; one of which is knowing an equation's long-run and short-run effects. After the best model is obtained, Table 4 can show the long-run and short-run effects of the Sys-GMM model. Lagged variable income inequality has a positive and significant influence. The foremost suitable government policy in diminishing income disparity is to consider backwards-looking.

Government spending has a negative and significant influence on income disparity. The GOVEXP coefficient shows an effect of 0.0298 at a significance level of 10 percent, thus if there is an increase in government expenditures by 1 percent, it causes a decrease in income disparity by 0.0298. In the long run, an increase in government expenditures can also reduce income inequality by 0.0696. This shows that government expenditures can reduce income inequality in all provinces in Indonesia.

A small effect indicates that an increase in government expenditures in areas with a low Gini coefficient has a negligible impact on income distribution, so government spending is relatively inefficient in reducing income inequality in areas that already have a more even distribution of income, as has happened in the following provinces, where the average government expenditure from 2007 to 2020 exceeds the national average (IDR 6.38 trillion) and the average income inequality is lower than the national average (0.36) that is, in the North Sumatra Province (IDR 7.59 trillion; 0.32), Riau (IDR 6.43 trillion; 0.35), Lampung (IDR 6.97 trillion; 0.32), and East Kalimantan (IDR 8.85 trillion; 0.35). However, government expenditures will be more efficient in these areas where the average government expenditure is higher nationally, but the average Gini coefficient is also higher than the national level, for example, DKI Jakarta (IDR 37.91 trillion; 0.40), the West Java Province (IDR 20.37 trillion; 0.39) and East Java (IDR 18.54 trillion; 0.37). Thus, the addition of regional government expenditures that have a high Gini coefficient will be more efficient in reducing income inequality (Baer, Galvão, 2008).

Likewise, previous studies have found similar results where stated that government spending, especially on infrastructure, can reduce income inequality (Alamanda, 2020). The analysis conducted by Sánchez and Pérez-Corral (2018) also shows that government expenditure on health and social protection has a negative and significant impact on income inequality in developing countries.

Gross regional domestic product shows a positive and statistically significant impact on income inequality. The coefficient of the gross regional domestic product shows an effect of 0.0521 in the short run, which means that if there is an increase in GRDP by 1 percent, it will cause an increase in income inequality by 0.0521. In the long run, an increase in GRDP can also exacerbate income inequality by 0.1216. This shows that GRDP can increase income inequality in all provinces in Indonesia. This study's results align with studies by Agusalim and Pohan (2018), which state that the GDP variable has a positive impact on income inequality, indicates that macroeconomic growth has not been enjoyed equally by the Indonesian population. Economic growth also exacerbates income disparity in the long run, and this inequality can be reduced by creating inclusive economic growth. Other empirical evidences also show a direct positive impact of per capita income on the Gini coefficient (Rubin, Segal, 2015; Nahum, 2005; Muinelo-Gallo, Roca-Sagalés, 2013). However, other research shows a negative and statistically significant effect between GRDP and income distribution between districts in Central Java, Indonesia (Soeharjoto, 2019).

The regional minimum wage shows a negative and statistically significant influence on income inequality. In the short run, RMW shows an effect of 0.0403, so if there is an increase in the regional minimum wage by 1 percent, it causes a decrease in income inequality by 0.0403 points. In the long run, an increase in RMW can also reduce income inequality by 0.0942. Increasing the regional minimum wage for regions in Indonesia should increase the income of millions of workers who earn low wages so that income inequality decreases. These findings are in line with those proposed by Lin and Yun (2016) and Engelhardt and Purcell (2021). Sotomayor (2021) states that a minimum wage increase in the first three months reduces the income disparity by 2.4 percent in Brazil, and the effect is gets stronger over time.

The increase in income disparity is also associated with a decrease in the minimum wage in Mexico (Bosch, Manacorda, 2010). For example, in the Yogyakarta Province, which received the lowest RMW among 33 other provinces in Indonesia in 2020, was IDR 1,704,608, with the highest inequality of 0.436 points. A study conducted by Howell (2020) in urban China found that the minimum wage significantly helped reduce aggregate wage inequality, where an average increase of 26 percent reduces the Gini coefficient by 10 to 12 percent. However, the results obtained are different from other studies, which say that the contribution of people's wage income in China continued to decline from 2005 by 81 percent and in 2010 to 69 percent (Lee, 2013).

The level of employment rate shows a positive and significant response to income inequality. The employment rate shows an effect of 0.0021 at a significance level of 10 percent, so if there is an increase in ER of 1 percent, it causes an increase in income inequality of 0.0021. In the long run, the addition of ER can also exacerbate income inequality by 0.0048. This is due to inequality in the labor market, where workers who have good skills get high salaries while other workers are trapped in informal jobs that require low productivity and low salaries. Because of their limitations, the workers do not get opportunities to develop their skills (Wicaksono, Amir, Nugroho, 2017; World Bank, 2016). People with high skills are more likely to be employed than those with low skills, but in the trade sector, mastery of technology can reduce the demand for low-skilled labour (Wolcott, 2020).

Therefore, equal distribution of education is the main key to developing human resources, both in mastering skills, industry, problem-solving, and creativity. The government, in this case, must encourage the public to participate in education in terms of the quality that follows the needs of the labour market, cost, and physical affordability in order to prepare a reliable workforce and stimulate the economy as a whole (Muin, 2020).

The severity of poverty in both the short run and long run shows signs that are in accordance with the theory but are not statistically significant on income inequality. This is because the severity of poverty is only seen from the calculation of a certain formula in which some people are below the poverty line. For example, in 2020, only 10 percent of the total Indonesian population is poor people. The World Bank's criteria divide the expenditure/income of the population into three groups: the lowest 40 percent of the population's expenditure, 40 percent of the middle population's expenditure, and the high 20 percent of the population's expenditure. The inequality only focuses on the percentage received by the 40 percent of the lowest income group of all incomes in a region (Statistics Indonesia, 2021; Heryanah, 2017). Thus the severity of poverty is a measure of income inequality among the poor, while income inequality is seen from the entire population.

Evan, Hout, and Mayer (2004) state that inequality is not only closely related to absolute poverty, where the poor are below the poverty line and are not sufficient to meet their minimum life needs, but the number of retirees, unemployment rates, consumption, and health levels also affect disparity (Annim, Mariwah and Sebu, 2012; Mintchev, Boshnakov and Naydenov, 2010). Therefore, there is great concern in society about income inequality among those who are poor or low-income when it comes to health status (Oshio, Kobayashi, 2009). Debebe, Zekarias (2020) and Ravallion (2005) mention that the higher the poverty rate, the higher the income inequality.

The Indonesian government has so far carried out various inclusive and affirmative development policies in overcoming income inequality, namely: 1) Development of a comprehensive social protection system. 2) Improvement of basic services to the poor. 3) Development of sustainable livelihoods for the poor through entrepreneurship and labor distribution (Kementerian Perencanaan Pembangunan Nasional/Badan Perencanaan Pembangunan Nasional, 2014). The government seeks to provide housing, provide clean water, and sanitation facilities for the poor in rural areas (Badan Perencanaan Pembangunan Nasional, 2013). Social assistance programs in the form of cash assistance to families of hope (PKH) for the poorest families, provision of subsidized rice to low-income residents (Raskin), scholarships to outstanding students (Bidikmisi), BOS assistance program for the education sector, empowerment of the poor through joint business groups (KUBe) and others. However, there are various problems in government programs where implementation is still very limited, the impact of the program has not been felt by the entire population, such as not yet properly targeting the beneficiaries of social protection assistance because the government is experiencing problems updating poor household data. Based on the 2013 Susenas data, only about 1.5 percent of the poor received social assistance, such as PKH and Raskin, from the poorest 10 percent of the population (Supriyanto, Ramdhani, Rahmadan, 2014).

4. Conclusions

Indonesia is country with one of the largest areas in the world, which consists of many islands, both small and large, but it has not been able to completely break the cycle of income inequality between provinces and overcome the problem of income inequality between regions. Nevertheless, nationally the Gini coefficient has decreased for the last six years before 2020. This article examines the effects of government spending, regional GDP, minimum wages, employment rate, and poverty severity on income inequality using the panel system Generalized Method of Moments (Sys-GMM) model.

The study results indicated that in both the short-run and long-run effects, government spending and the regional minimum wage encourage a reduction in income inequality. Targeted government spending, such as spending on health and social protection for people below the poverty line and increasing regional minimum wages for low-wage workers, can encourage development to reduce income inequality.

However, regional GDP and a high employment rate may not necessarily reduce inequality; even in the long run, it will exacerbate inequality because a high regional GDP can create economic disparities between regions. After all, regional economic growth measured by GRDP at a macro level cannot be enjoyed equally by all. If adequate skills do not accompany the high employment rate, it will also be unable to reduce inequality.

The decrease in the severity of poverty among the poor does not affect the decline in the Gini coefficient because there are other factors, such as health and consumption, which have a more direct influence. The measure of poverty severity only looks at income inequality among the poor. However, inequality only focuses on the percentage received by the 40 percent of the lowest income group of all incomes in a region.

This article recommends the Indonesian government to hold training in mastering information, communication, and technology (ICT) for low-income and poor people because mastering technology can expand creativity and create job opportunities for people who have low skills. It also suggested to provide credit for micro, small and medium enterprises in agriculture and fisheries is necessary because most of the poverty is at this sector. Government investment in the sector that absorbs a large workforce is also needed as well as conducting various training in skills development and internships. Improving the quality of basic public services at the local level, such as health services, is important because good health increases work productivity and income. Finally, food price stability and targeted subsidies can reduce the burden on the poor, thereby reducing income inequality.

The main limitation of researchers in analyzing the problems that exist in Indonesia is that this study has not explained the causes of income inequality in each province in detail. Indonesia consists of several large islands and a very wide area; even the size of an island in Indonesia can be equivalent to a country. Therefore, the causes of income inequality, economic development, and poverty are different in each region. This study describes an empirical analysis of old issues that are still considered important today.

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