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Nonlinear effects of income inequality on economic growth: A comparative analysis of selected countries

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Abstract

Purpose — The paper queries the impacts of income inequality on economic growth in selected advanced and emerging market economies by adopting nonlinearity and endogeneity.

Methods — This research analysis is based on a balanced panel from 1996 to 2018 and employs the dynamic panel threshold analysis after baseline estimations with the fixed-effect, system Generalized Method of Moments, and difference Generalized Method of Moments.

Findings — This study finds a nonlinearity between income inequality and economic growth. Income inequality has a significant threshold effect on the growth of both panels. Besides, the threshold effect of emerging market countries is higher than the level for advanced countries. This means emerging market economies are negatively affected above the estimated threshold value according to the advanced economies.

Implication — This paper supports that inequality may harm much more economic growth above a specific level. On the other hand, these distorting effects are related to the other economic issues of countries, such as government spending, inflation, export of goods and services, gross fixed capital formation, and foreign direct investment.

Originality — This paper contributes to the literature by focusing on the nonlinear effects of income inequality and different aspects of economic growth above or below the estimated threshold value, thereby providing cross-country comparability and endogeneity.

Keywords — Income inequality, economic growth, threshold analysis, dynamic panel, nonlinearity

Introduction

Theoretical discussions on the relationship between income inequality and economic growth and empirical studies after the middle of the last century are quite intense. The overall conclusion is that it could be solved by increasing welfare or by distributing wealth generated in an economy/society. On the other side, it is revealed that somewhat inequality can increase economic capacity favoring some income groups (high-income groups) that inequality can be reduced with economic growth so that disadvantaged low-income groups can have their share. It is desirable to implement an optimal policy combination that simultaneously reduces income inequality and increases economic growth and expected results may not occur due to many political, economic, global, and social factors. So, interest in the inequality-growth nexus requires determining the extent

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of the relationship. Early and classical theoretical and empirical studies on the effect of income inequality on economic growth find out that inequality positively or affects economic growth, while subsequent modern theories and empirical studies conclude with the negative inequality impact on economic growth. Later empirical studies have determined that the direction of the relationship diversifies and is not linear. However, the existence of incompatible results and the probable multiple and nonlinear relationship correlation lead to the questioning that inequality can affect economic growth through different channels such as macroeconomic, socio-economic, and political issues.

The first study, the cornerstone of empirical studies and modelling, belongs to Kuznets (1955). Kuznets addresses how income is distributed among the population and inequality in terms of how total income is earned among low, middle, and high-income groups in the economy. Although the period conditions pose difficulties in obtaining reliable data, Kuznets' study is a major starting point for some implications (Kuznets, 1955; Todaro & Smith, 2012). Kuznets states that inequality initially increases as economic growth increases in different income groups, then decreases and takes the form of an inverted U curve. This is expressed as the Kuznets inverse U curve theoretically (Lahouij, 2017). It is stated that high and low GDP is correlated with low-income inequality, and a medium level GDP is correlated with high-income inequality (Kuznets, 1955). The Kuznets curve is no longer efficient, while the global income inequality is detailed. It is stated that this curve transforms into the shape of Kuznets waves that increase and decrease inequality will not be efficient to determine inequality alone (Milanovic, 2016). Thomas Piketty criticizes Kuznets' study. Piketty states that the reduction of inequality does not result from social mobility. Piketty has claimed that these is the historical or periodic effects of world wars and the fiscal tightening of high US revenues between 1913-1948 was due to these effects (Piketty, 2014).

Many studies indicate that the income inequality and economic growth relationship is negatively related. Studies by Alesina & Perotti (1994) state that the nexus is negatively correlative. Alesina and Rodrik (1994) assume that the relationship between inequality and growth is negative. Birdsall et al., 1995 and Birdsall et al., 1996 conduct a specific study on Latin America and East Asian countries. It is indicated that there is a negative relationship between income inequality and economic growth in Latin America in contrast to the previous study. Knowles (2005) states a negative relationship between inequality and growth and emphasizes income inequality after redistribution for the period 1960-1990. Wahiba and Wariemmi (2014) estimate the relationship between income inequality and economic growth for Tunisia under the period 1984-1995 and 1996-2011. It is concluded that income inequality is negatively associated with economic growth (Wahiba & Wariemmi, 2014). Cingano (2014) has estimated the period between 1970 and 2010 with 5-year average growth data for 31 OECD countries. The results show that inequality harms economic growth (Cingano, 2014). Lahouij (2017) focuses on selected oil-importing MENA countries. Income inequality slows the rate of economic development; that is, it slows down economic growth (Lahouij, 2017). Michálek and Výbošťok (2019) observe changes in economic growth expressed by real gross domestic product and inequality ratio in the reduction of relative poverty for 28 European Union countries from 2005 to 2015 (Michálek & Výbošťok, 2019). The findings reveal that economic growth is connected to reducing poverty and inequality. Strong economies can better combat inequality and poverty during a crisis. As income inequalities increase, poverty also rises. The negative coefficient of the Gini indicates that inequality hurts economic growth (Michálek & Výbošťok, 2019).

There are also studies reaching positively related findings. Saint-Paul and Verdier (1993) suggest that higher economic growth rates can occur in an unequal economy. Li and Zou (1998) predict that there should be a positive relationship between income inequality and economic growth by classifying government expenditures related to their structures for production and consumption. Forbes (2000) estimates 30 years between 1966-1995 and five years of average growth data and dummy variables for 45 countries. A positive correlation has been confirmed between income inequality and economic growth (Forbes, 2000). Chletsos and Fatouros (2016) test the relationship between 1968 and 2007 with panel data analysis for 126 countries. It is stated that income inequality may enhance while economic growth goes up (Chletsos & Fatouros, 2016).

Yang and Greaney (2017) estimate the short and long-term relationship between income inequality, economic growth, and redistribution over the period 1960-2014 for China, Japan, South Korea, and the USA. A general conclusion is revealed that increasing income inequality promotes economic growth (Yang & Greaney, 2017).

Some studies state that the inequality-growth nexus cannot be *single-sided* and *linear*. Banerjee and Duflo (2003) conclude a nonlinear relationship between inequality and growth for 45 countries. It is stated that high inequality encourages growth in more egalitarian societies (Banerjee & Duflo, 2003). Khalifa and El Hag (2010) reveal that the inequality-growth relationship is negative and significant below the income per capita threshold. The relationship is positive but less significant above the threshold (Khalifa & El Hag, 2010). Cho, Kim, and Rhee (2014) state that income inequality has nonlinear effects on economic growth by using the panel regression model. It is stated that inequality prevents economic growth in most countries and accelerates economic growth only in Denmark where the level of inequality is very low (Cho et al., 2014). Delbianco, Dabús, and Caraballo (2014) argue that inequality supports economic growth for the wealthiest 10% of higher-income countries. Fawaz, Rahnama, and Valcarcel (2014) determine that income inequality contributes to economic growth in high-income countries and the contrary exists for low-income countries with a threshold effect. Kolev and Niehues (2016) state that economic growth is negatively connected with net income inequality for countries with low GDP per capita. However, the impact is weakening as GDP increases and is positive even for developed countries (Kolev & Niehues, 2016). As a recent study, Aktas (2019) analyzes the relationship utilizing Hansen (1999) which enables us to consider nonlinearity. The study evaluates whether income inequality will lead to economic growth by using Hansen (1999) threshold analysis. The analysis covers 11 separate panels. A balanced panel is developed with annual and five-year average data from 1996 to 2016 for 60 countries. The findings of the analysis vary in terms of the threshold effect of income inequality on economic growth, reaching significant and insignificant results in separate panels.

By extension of Aktas (2019), the economic growth impact of income inequality is evaluated using the dynamic panel data threshold analysis proposed by Kremer, Bick, and Nautz (2013) in this paper. Our study considers nonlinearity and provides a dynamic framework that avoids endogeneity. Contributing to this wide literature, we develop a nonlinear framework by examining the impact of income inequality on economic growth for 60 advanced and emerging market economies over 1996 and 2018. It is of great importance to consider the relationship between income inequality and economic growth in a dynamic framework because growth is based on the economic performances of previous periods. Furthermore, the method of the study provides the elimination of problems such as endogeneity, multicollinearity, and autocorrelation. We implement the panel threshold methodology for three country groups. More clearly, after examining all countries in a single panel, estimations have been made in two more panels for 32 emerging markets and 28 advanced economies under the International Monetary Fund (IMF) classification. We also avoid methodological issues such as endogeneity using a dynamic approach. Our paper is organized as follows. In the first part, we emphasize the theoretical and empirical background. Then, we present data and methodology. In the succeeding part, we address empirical findings. Finally, we conclude with specific policy implications.

Methods

Data

Our sample covers 60 advanced and emerging market countries as shared in Appendix 1. IMF classifies 189 economies whole over the world as follows: Advanced Economies, Euro Area, Major Advanced Economies (G7), Newly Industrialized Asian Economies, Other Advanced Economies (excluding G7 and Euro Area), European Union, Emerging and Developing Economies, Central and Eastern Europe, Commonwealth of Independent States, Developing Asia, ASEAN-5 Countries, Latin America, and the Caribbean, the Middle East and North Africa, Afghanistan, Pakistan, Sub-Saharan Africa, and G-20 (Group of 20). The countries that obtained data mostly dissipation less is annexed to the data set, and the countries are split as 32 advanced and 28 emerging market economies following the IMF classification. Income inequality data has some limitations, such as measurement problems, sparse coding, and limited comparability across countries and over time. Income inequality calculations of the Standardized World Income Inequality Database (SWIID), which has been widely used in recent years, are utilized in our study. The database has a comparative advantage over other alternatives since it meets the requirements of the researchers by maximizing the comparability of income inequality data while maintaining the widest possible coverage across countries and over time. SWIID filters the Gini coefficients based on the relative values of income from different sources (Solt, 2020). We utilize the Gini Market variable in our models to focus on the inequality effect. Following empirical literature, control variables are preferred from among investment, consumption, capital, and trade variables that are assumed to affect economic growth. All control variables are obtained from the World Bank database. All data include annually between 1996 and 2018. Table 1 represents the detailed information of the data.

Table 1. Data information

Variables	Index/Indicator	Basic theory or study on which it is based	Source
Explanatory Variable: Income Inequality	Gini inequality index is equalized with household disposable income (before taxes and transfers) *(GINI)*	Yang and Greaney (2017)	Standardized World Income Inequality Database (SWIID)
Dependent Variable: Economic Growth	The growth rate of GDP per capita (annual %) (*y*)	Alberto Alesina and Rodrik (1994); Cingano (2014); Delbianco et al. (2014); Khalifa and El Hag (2010); Knowles (2005); Kolev and Niehues (2016)	World Bank Open Data
Control Variables			
Export	Exports of goods and services (% of GDP) *(EXP)*	Cho et al. (2014); Lahouij (2017); Wahiba and Wariemmi (2014); Yang and Greaney (2017)	World Bank Open Data
Investment	Foreign direct investment, net inflows (% of GDP) *(FDI)*	Alesina and Perotti (1994); Chletsos and Fatouros (2016); Lahouij (2017)	World Bank Open Data
Capital	Gross fixed capital formation (% of GDP) *(INV)*	Alesina & Perotti, (1994); Nancy Birdsall et al., (1995); Lahouij, (2017); Li & Zou, (1998); Yang & Greaney, (2017)	World Bank Open Data
Expenditure	Government consumption of expenditure (% of GDP) *(GOV_SPE)*	Alesina & Rodrik, 1994; Birdsall et al. (1995); Li and Zou (1998); Lahouij, (2017); Yang and Greaney (2017)	World Bank Open Data
Inflation	Inflation, consumer prices (annual %) *(INF)*	Alesina & Perotti, 1994; Chletsos & Fatouros, 2016; Lahouij, (2017)	World Bank Open Data

Note: Created by the authors.

As can be seen from the summary statistics reported in Table 2, no significant variations in the measurement of income inequality (Gini coefficient) and GDP per capita are not found. The mean and standard deviation of the Gini coefficients for emerging markets and advanced economies are close to each other. From control variables, inflation and export differ greatly across the countries. Diversification in other control variables is negligible.

Table 2. Summary statistics

Variable	All Economies		Emerging Market Economies		Advanced Economies	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
(y) (annual %)	2.77	3.59	2.13	3.41	3.23	3.87
(GINI)	46.11	6.45	46.41	5.70	46.09	7.14
(EXP)	47.05	32.38	104.55	79.38	86.56	37.65
(FDI)	5.54	8.21	7.41	10.92	4.35	5.36
(INV)	22.71	5.09	23.24	4.94	24.51	6.46
(GOV_SPE)	16.16	5.07	18.97	4.33	14.24	4.62
(INF)	7.20	31.61	2.18	2.23	12.18	44.04

Note: Listed by the authors.

This paper uses a panel threshold regression modelling proposed by Hansen (1999) to assess the hypothesis that income inequality plays an important role in economic growth. Then, a dynamic panel threshold model is designed by expanding Hansen (1999) original model setup and following Caner and Hansen (2004) and Kremer et al. (2013). A model is designed where GMM type estimators are brought to a dynamic setting. Besides, as shown by Doytch and Uctum (2011), the Generalized Method of Moments which is used in this paper within the framework of dynamic panel data analysis, has the advantage of eliminating the autocorrelation, endogeneity, and multicollinearity problems that can be arisen in large panels. The threshold estimation analysis is employed because this methodology is more flexible to accommodate the possible contingency effect in the inequality-growth link. This procedure allows the data to determine the numbers and locations of the threshold points endogenously. We argue that the model is well suited to capture the presence of contingency effects and offers a rich way of modelling the influence of income inequality on economic growth.

Baseline Model

Within the scope of our study, we implement a model to investigate the nexus between economic growth and income inequality empirically. A baseline model is set up before the dynamic panel threshold model (Delbianco et al., 2014). The baseline model of the relationship is represented by equation (1).

$$y_{it} = \alpha_i + \lambda_t + \beta 1 g_{it-1} + \beta 2 g_{it-1}^2 + \beta 3 y_{it-1} + X_{it}\gamma + u_{it} \quad (1)$$

i = 1, . . . , N and t = 1, . . . , T

y_{it} is the growth rate of GDP per capita (annual %) for each country *i* at time *t*. g_{it} denotes the measurement of income inequality as the Gini coefficient. u_{it} shows the error term, α_i, and λ_t present the country, and time-specific effects (fixed effects), X_{it} is a vector of control variables. Besides, the quadratic term of the Gini coefficient g_{it}^2 is defined under the assumption that income inequality on growth is linear or nonlinear. Three estimation models that are frequently used in the growth and inequality literature represent the baseline results under equation (1). The fixed-effects model may result in inconsistent estimates in the presence of time-varying omitted factors that affect inequality and growth. On the other hand, it may not estimate the causal effect of income inequality on economic growth and cause the lagged dependent variables to be related to the transformed error term. This eliminates a significant portion of changes in income inequality and other explanatory variables and causes significant measurement errors. The generalized method of moments (GMM) estimator allows the endogeneity of income inequality that can result from reverse causality and measurement errors. The GMM estimators are preferred more frequently because the fixed effects model may decrease the significance of the findings. Consequently, baseline estimation regressions are conducted under the three estimation methods which are panel fixed-effect, system GMM, and difference GMM. The heterogeneity between countries and the nonlinearity of the relationship is also a common challenge in the inequality-growth literature. Thus, we implement a dynamic threshold regression to overcome the mentioned problems.

Threshold Regression

Unlike traditional theories, Hansen (1999) offers an asymptotic distribution theory that can estimate the threshold regression models using the bootstrap method. This approach develops the existing theory by using threshold regression techniques. Threshold regression models state that individual observations can be divided into classes according to the value of an observed variable. The study describes the econometric techniques appropriate for threshold regression with panel data. For model estimation, first, a two-stage ordinary least squares model is used, where the sum of error squares is calculated independently for each of the possible threshold values, and secondly, these values are minimized. In the final step, coefficient parameters are estimated in identified different regimes based on the threshold value (Caner & Hansen, 2004; Hansen, 1999, 2000). It is possible to consider the panel threshold model put forward by Hansen (1999) within the framework of the purpose and variables of this study. Hansen (1999) original threshold model can also be used in a dynamic context under the orthogonal deviation transformation (Kremer et al., 2013). The following threshold model of the growth-inequality nexus:

$$y_{it} = \begin{cases} \delta_i + \alpha_1 X_{it} + \beta_1 GINI_{it} + e_{it}, GINI_{it} \leq \lambda \\ \delta_i + \alpha_2 X_{it} + \beta_2 lnGINI_{it} + e_{it}, GINI_{it} > \lambda \end{cases} \quad (2)$$

The significance of the threshold effect test is necessary to determine whether the relationship is linear or not. Hansen (1999) evaluates the aspect of the effect below and above the threshold value if a significant threshold effect is identified. After estimation with the baseline model, it is necessary to re-estimate the model with a dynamic panel threshold analysis to compare the (non)linearity and endogeneity. If the p-value is smaller than the desired critical value, the null hypothesis of no threshold effect is rejected. If a significant threshold effect is identified (F-statistics of the threshold effect test), the existence of a nonlinear relationship is accepted in two different regimes. In the case of identifying the threshold effect, two and three threshold modelling can be done.

The methodology provides a convenient framework to examine the study's research questions: Is the nexus between growth and inequality linear or nonlinear? If the nexus is nonlinear, does income inequality have a significant threshold effect on economic growth? If it has, what is the aspect of the relationship (negatively or positively related to growth) under and below the threshold level of inequality? The model figured in this framework allows the determination of threshold values by dividing the sample internally into subgroups to analyze the growth effects of income inequality. Thus, the relationship can be identified in various ways depending on the threshold value. In the model established with a balanced panel data set and containing individual effects *(i)* and time effects *(t)*; y_{it} shows the economic growth, which is defined as the annual growth rate of GDP per capita, the $GINI_{it}$ is the explanatory variable which is the indicator of income inequality, and the threshold variable which is assumed not to be constant over time, and X_{it} is the other control variables vector. λ shows the estimated threshold value. δ_i denotes the fixed effects representing the heterogeneity of the countries with different inequality levels, and e_{it} refers to the error term assumed to be distributed independently and identically with zero mean and infinite variance. The slope parameters (β_1, β_2) in the equation reveal the effect of income inequality in different regimes, in other words, below and above the threshold value. The income inequality variable ($GINI$) is defined as both the threshold variable and the regime-dependent variable.

A model is designed where GMM type estimators are brought to a dynamic setting. Then, a dynamic panel threshold model is designed by expanding Hansen (1999) original model setup in addition to the linear model. Besides, as shown by Doytch and Uctum (2011), the Generalized Method of Moments used in this paper within the framework of dynamic panel data analysis has the advantage of eliminating the autocorrelation, endogeneity, and multicollinearity problems that can be arisen in large panels.

$$y_{it} = \mu_i + \beta_1 z_{it} I(GINI_{it} \leq \Upsilon) + \beta_2 z_{it} I(GINI_{it} > \Upsilon) + + \varepsilon_{it} \quad (3)$$

Υ is the fixed threshold that is estimated through least squares for the ultimate model. μ_i shows the country fixed effect. z_{it} is a multi-dimensional vector of explanatory variables, and it may involve lagged values of other endogenous variables. The error term is ε_{it}. y_{it} denotes the GDP per capita growth rate and $GINI_{it}$ is the threshold variable. Υdetermines the growth effect of inequality under and above $GINI_{it}$. I is the indicator function determined depending on the regime. We consider endogenous regressors, including the lagged of dependent variable GDP per capita (annual %), and employ the threshold model of Caner and Hansen (2004) to allow endogeneity. We also apply the dynamic panel threshold model which is developed by Kremer et al. (2013). The essential problem is transforming the panel threshold model to eliminate country-specific fixed effects (Hansen, 1999). There should not be an autocorrelation in the error terms.

For this reason, it is not applicable to eliminate the standard fixed effects in dynamic panels with the first difference. This difficulty is solved by using advanced orthogonal deviation transformation, which eliminates the fixed effects proposed by Arellano and Bover (1995). It also prevents serial correlation in the transformed errors (Caner & Hansen, 2004; Kremer et al., 2013):

$$Var(\varepsilon_i) = \sigma^2 I_T \text{ and } Var(\varepsilon_i^*) = \sigma^2 I_{T-1}. \quad (4)$$

The conversion (transformation) of the error term is as follows (Kremer et al., 2013, p. 18).

$$\varepsilon_{it}^* = \sqrt{\frac{T-t}{T-t+1}}\left[\varepsilon_{it} - \frac{1}{T-t}(\varepsilon_{i(t+1)} + \cdots + \varepsilon_{iT}\right] \quad (5)$$

$$\widehat{\Upsilon} = \min\left(\Upsilon \epsilon \Gamma\right) S_n(\Upsilon) \quad (6)$$

Equation (6) represents the determination of the threshold level. The threshold level is computed by the two-stage least squares method. $S(\Upsilon)$ represents the sum of squared residuals from the (2SLS) method. First, reduced form regression is estimated for the endogenous variables z_{it}, as a function of the instruments x_{it}. Υ is chosen as the connected one with the smallest sum of squared residuals. Once $\widehat{\Upsilon}$is identified, the slope coefficients can be estimated by using the generalized method of moments. $\Gamma = \{\Upsilon: LR(\Upsilon) \leq C\}$ shows the confidence interval for the threshold estimate. C presents the 95% confidence interval. $LR(\Upsilon)$ percentile of the asymptotic distribution of the likelihood ratio statistic (Caner & Hansen, 2004; Hansen, 2000; Kremer et al., 2013).

Results and Discussion

Table 3 presents the baseline estimation results given in Equation (1). Three estimation models that are frequently used in the growth and inequality literature represent the baseline results. In GMM estimations, AR(1) test proves first-order autocorrelation, and AR(2) test proves second-order autocorrelation. The AR(1) test result is expected to be statistically significant, while the AR(2) test result is expected to be statistically insignificant. In other words, even if there is first-order autocorrelation in the model, it means that there is no second-order autocorrelation problem. According to the results, there is first-order and no second-order autocorrelation in first-differenced residuals. Whether the estimation results of the GMM method are valid or not can be analyzed with different post-estimation tests such as the Sargan test, Hansen-J test, and autocorrelation test. With the Sargan and Hansen-J tests, the validity of the estimations is tested with the instrument variables, and it is measured whether the instrument variables fully reflect the actual variables. The results obtained from the Sargan and Hansen-J tests are used to determine whether the instrument variables used for GMM estimation are valid or not. If the instrumental variables are used exogenous, the residuals are uncorrelated with the explanatory variables. If there is heteroscedasticity in the model, the difference in the Hansen-J test is used. In addition, the externality of the instrumental variables can be tested with several Hansen tests. On the other hand, in GMM estimations, the Hansen-J test checks over-identification constraints, and the difference in the Hansen-J test checks the externality of instrumental variables. It is accepted that the number of instruments should not exceed the number of units in GMM estimations, as excessive instrument usage leads to biased results, as a rule of thumb.

Table 3 reflects the p-values of all these diagnostic tests. According to the results in both tests, the high exact probability value indicates that the instruments are valid. Besides, the Sargan test results show that overidentifying restrictions are valid. The effect of inequality on growth is highly significant in the three models. The square of the GINI coefficient is defined under the assumption that growth will be adversely affected if the inequality is high. Therefore, the quadratic term of the Gini coefficient is determined for testing (non)linearity in the inequality-growth nexus. The inequality coefficients in the three model results are initially positive. The coefficients of the square of the GINI coefficient are negative. These results indicate that if income inequality is extremely high, economic growth may be affected negatively, and nonlinearity in the nexus of the inequality-growth should be retested. The results are similar to Cho et al. (2014) and Fawaz et al. (2014). Coefficients of control variables are significant. As Cho et al. (2014) and Delbianco et al. (2014) have claimed, expenditure and inflation harm growth.

Table 3. Baseline estimation results for all sample economies

Dependent Variable: (y)	Fixed Effect		System GMM		Difference GMM	
	Coefficient	Standard Errors	Coefficient	Standard Errors	Coefficient	Standard Errors
L1			0.169***	0.009	0.181***	0.026
L2			-0.113***	0.005	-0.071***	0.025
$(GINI)$	1.763***	0.589	0.619***	0.145	0.785***	0.202
$(GINI)^2$	-0.019***	0.006	-0.018***	0.005	-0.079***	0.012
(EXP)	0.011**	0.005	0.001	0.003	0.037**	0.015
(FDI)	0.073***	0.014	0.068***	0.010	0.079***	0.016
(INV)	0.114***	0.024	0.224***	0.014	0.159***	0.038
(GOV_SPE)	-0.438**	0.052	-0.753***	0.036	-0.056***	0.088
(INF)	-0.007***	0.002	-0.027***	0.001	-0.028***	0.010
R^2	0.061					
Number of observations	1380		1260		1200	
Number of countries	60		60		60	
Arellano-Bond test for AR(1) (p-value)			0.005		0.025	
Arellano-Bond test for AR(2) (p-value)			0.998		0.869	
Sargan test of joint validity of instruments (p-value)			0.839		0.736	
Hansen-J test (p-value)			0.613		0.529	
Difference in Hansen-J test (p-value)			0.165		0.891	
Number of instruments			47		49	
Periods	1996-2018		1996-2018		1996-2018	

Notes: ***, ** and * indicate the significance at 1, 5, and 10% levels, respectively. Variable names ending in L1 and L2 indicate lagged copies of the dependent variable.

The dynamic panel threshold estimation results for advanced, emerging markets and all sample economies are summarized in Table 4, following the panel threshold model represented in Equation (7). We aim to estimate the long-term impact of income inequality and the economic growth relationship by considering the nonlinearity. The model refers to a Generalized Method of Moments (GMM) type estimator to account for endogeneity by following Caner and Hansen (2004) and Kremer et al. (2013). We apply the dynamic panel threshold model to analyze the inequality effect on growth in all sample economies, advanced economies, and emerging market economies. The new (dynamic) model of the inequality-growth nexus is as follows:

$$y_{it} = \mu_i + \beta_1 x_{it} I(\delta_{it} \leq \Upsilon) + \beta_2 x_{it} I(\delta_{it} > \Upsilon) + \varepsilon_{it} \quad (7)$$

x_{it} denotes the vector of control variables that intervene in the nexus between growth and inequality. The dependent variable (y_{it}) is the lagged value of GDP per capita (annual %). δ_{it} is the threshold variable that represents the heterogeneity of the countries with different inequality levels, and beyond (Υ), which its impact on economic growth can alternate. β_1, β_2 are the vector of regime-dependent slope parameters that reveals the effect of inequality on growth. ε_{it} is the error term and μ_i presents the country fixed effect. Control variables are included in the estimated model as shown in Table 1. The threshold variable is the Gini coefficient as Gini Market. As the value of the Gini coefficient comes close to 0, the inequality decreases. The Gini coefficient $GINI_{it}$ is both the threshold variable and the regime-dependent variable and the estimated Gini coefficient threshold corresponds to 95% confidence intervals.

As shown from Table 6, the threshold level of the Gini coefficient is nearly 40 for all sample countries, is nearly 36 for advanced economies, and is approximately 40 for emerging market economies. So, the nonlinearity effect has been detected. The threshold level is lower for advanced economies than the level for emerging market economies. This indicates that income inequality has a more positive effect on economic growth in advanced economies than in emerging market economies (35.65 < 39.59). If the measure of inequality reaches a higher level than the threshold level, it can be said that inequality has an adverse (negative) effect on economic growth. We conclude that the level of inequality differently affects economic growth in the two regimes. In other words, as the measure of inequality increases, economic growth is negatively affected. β_1, β_2 present the estimated threshold value. The marginal effect of income inequality on growth in the low-inequality and high-inequality regimes, respectively. Although the coefficients are not statistically significant in the high inequality regime for advanced and emerging market economies, the signs of the coefficients are in line with the expectation. This means economic growth is positively affected in the low-inequality regime ($\Upsilon \leq$ 39.59-35.65), and negatively affected in the high-inequality regime ($\Upsilon >$ 39.59-35.65). Findings show that the negative impact of income inequality is stronger when income inequality is high. This explains the reasons for the incoherent findings achieved in the literature with linear modelling. The higher inequality thresholds for emerging market economies and all sample economies may be associated with insufficient convergence excess because the coefficient of the initial income is positive.

Most of the control variables are statistically significant for advanced and emerging market economies. The coefficients of the variables are with the expected sign. Inflation and expenditure negatively affect economic growth. Capital, investment, and export positively affect economic growth. The coefficient of the inflation variable is not significant for advanced and emerging market economies. It has the expected negative sign. The coefficient of the initial income variable is not significant for only advanced economies. The studies of Banerjee and Duflo (2003); Cho et al. (2014); Delbianco et al. (2014); Fawaz et al. (2014;) Khalifa and El Hag (2010); Kolev and Niehues (2016) find that inequality and growth nexus is nonlinear, or the aspect of the relationship changes based on the initial income. The impact(s) of Gini_mkt on economic growth in two different regimes, as noted in Table 3 for whole country groups, are similar to these studies. In another saying, the determined inequality threshold levels (39.59, 35.65, 39.59) explain the nonlinearity in the inequality-growth nexus by dividing the link into two regimes (negative aspect below the threshold level and positive aspect above the threshold level). However, when inequality is too high, the economy can be disrupted through rent-seeking activities.

The distribution of factors can also disrupt it before taxes, transfers and redistribution policies after taxes and transfers. The high level of income inequality can lead to social unrest and conflicts arising from inequality in society. This may discourage investment and latent economic growth. The countries with income inequality above a threshold level of Gini coefficients are more likely to experience a negative impact on the long-term growth rate of the GDP per capita. In brief, the relationship between income inequality and economic growth is negative at higher income inequality levels and positive at lower inequality levels. The aspect of the inequality effect (the signs) turns negative from positive when the Gini coefficient is almost 40 for all sample and emerging market economies and almost 36 for advanced economies. These results show that income inequality harms economic growth above the threshold value in three panels. The threshold inequality level is higher for emerging market economies compared to advanced economies.

Table 4. Dynamic Panel Threshold Estimation Results

All Economies			Advanced Economies			Emerging Market Economies		
Threshold variable: Gini_mkt			Threshold variable: Gini_mkt			Threshold variable: Gini_mkt		
Threshold estimate: 39.59			Threshold estimate: 35.65			Threshold estimate: 39.59		
(95% confidence interval)			(95% confidence interval)			(95% confidence interval)		
Impact of Gini_mkt			Impact of Gini_mkt			Impact of Gini_mkt		
	Coefficient	Standard Errors		Coefficient	Standard Errors		Coefficient	Standard Errors
Regime 1: β_1	1.344*	0.065	Regime 1: β_1	0.574**	0.256	Regime 1: β_1	1.492***	0.087
Regime 2: β_2	-0.135**	0.055	Regime 2: β_2	-0.042	0.110	Regime 2: β_2	-0.114	0.075
Impact of covariates			Impact of covariates			Impact of covariates		
(y)	0.041***	0.013	(y)	0.060	0.051	(y)	0.058***	0.020
(INF)	-0.006***	0.002	*(INF)*	-0.043	0.097	*(INF)*	-0.005	0.001
(INV)	0.110***	0.034	*(INV)*	0.172***	0.068	*(INV)*	0.103***	0.041
(FDI)	0.069***	0.022	*(FDI)*	0.077***	0.030	*(FDI)*	0.055*	0.029
(GOV_SPE)	-0.463***	0.066	*(GOV_SPE)*	-0.818***	0.102	*(GOV_SPE)*	-0.315***	0.084
(EXP)	0.010*	0.006	*(EXP)*	0.018*	0.009	*(EXP)*	0.013***	0.009
Number of observations	1380		Number of observations	644		Number of observations	736	
Number of countries	60		Number of countries	28		Number of countries	32	

Notes: ***, **, and * indicate the significance at 1, 5, and 10% levels, respectively.

Conclusion

Income inequality is a concept that has aroused much interest recently, supported by previous studies and theories that it has a clear impact on economic growth. A few studies survey the threshold regression in the inequality-growth nexus. This paper examines the income inequality impact on economic growth and queries whether the relationship between inequality and growth diversifies with the threshold level of inequality or not. The relationship between income inequality and economic growth is evaluated in two different regimes depending on the income inequality threshold in this study based on Hansen (1999) threshold value approach. Thus, the broad panel used in the study is divided based on the IMF per capita income level, and the relationship is analyzed in this context. More specifically, dynamic panel threshold analysis improved by Kremer et al. (2013) is used for the estimation under Hansen (1999) and Caner and Hansen (2004) panel threshold method. All panels cover annual data for 60 countries between 1996 and 2018 to identify the long-term inequality effect on growth. After baseline estimation, we find a nonlinear relationship between economic growth and income inequality. The estimation results indicate that nonlinearity and heterogeneity in the inequality-growth nexus need to be considered, as inequality may lead to economic growth with a lower-inequality level, particularly in the emerging market economies rather than the advanced economies. This study has some limitations, such as the study results cannot be generalized because different developing countries, and country groups, have different economic features. The inequality-growth nexus should be evaluated with attentive considerations of important specification issues and data limitations in cross-country panel data, such as nonlinearity and the efficiency of covariates. Moreover, other channels through which inequality and growth are correlative can be analyzed.

Estimation results show that the negative impact of inequality on economic growth is more significant when the income inequality level is above the estimated threshold level for all panels. The findings that growth rates of high-income countries may slow down in the face of an increase in inequality and that emerging market economies can achieve growth even at a higher-inequality level reveal that policymakers should consider the economic conditions during the decision-making process and its' implementation. A redistribution policy may significantly affect whether inequality will generate growth since the Gini market coefficient, which is equalized with household disposable income before taxes and transfers, is identified in the estimation. A social welfare policy that redistributes income may increase economic growth, but this depends on the proper definition and quality of the implementation. On the other hand, if income inequality increases depending on the country's income level and development level, the redistribution policy may also slow down economic growth. Therefore, it becomes more noteworthy that future studies should evaluate tax and transfers. Economic growth can be another solution to reduce income inequality. However, economical solutions that will be effective in increasing economic growth should be well determined by policymakers. As can be seen from the signs of the coefficients of the control variables, the economic efficiency depends on the main factors such as the increase in export, realization of the expenditures and investments in productive areas, the increase of foreign direct investments, the formation and accumulation of domestic capital and low inflation.

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Appendix 1

Table 1. List of sample countries

Canada*	Greece*	Armenia**	Ecuador**
Denmark*	Netherlands*	Hungary**	Mexico**
Finland*	Portugal*	Colombia**	Peru**
Hong-Kong*	Slovenia*	Panama**	Romania**
Ireland*	Spain*	Poland**	Bolivia**
Israel*	Sweden*	Costa Rica**	Georgia**
South Korea*	Italy*	Kazakhstan**	Belarus**
Austria*	France*	Malaysia**	Kyrgyzstan**
New Zealand*	Germany*	Namibia**	Moldova**
Norway*	Estonia*	Paraguay**	Vietnam**
Belgium*	Czechia*	Russia**	Bangladesh**
Singapore*	Lithuania*	Turkey**	El Salvador**
Taiwan*	Puerto Rico*	Honduras**	Mongolia**
The United Kingdom*	Dominican Republic**	Bulgaria**	Sri Lanka**
The United States of America*	Indonesia**	Uruguay**	Ukraine**

Note: *, ** present the advanced and emerging market economies, respectively.