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WORKING PAPER

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Editor

Bree Ahrens
(Australian Volunteers International)

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For further information on SMERU's publications, please contact us on 62-21-31936336 (phone), 62-21-31930850 (fax), or smeru@smeru.or.id (e-mail); or visit www.smeru.or.id.

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ABSTRACT

Estimating the Impact of Inequality on Growth and Unemployment in Indonesia

Athia Yumna, M. Fajar Rakhmadi, M. Firman Hidayat, Sarah E. Gultom and Asep Suryahadi

Increasing inequality is a growing concern is many parts of the world. This paper provides empirical evidence of the impact of inequality on economic growth and unemployment in the Indonesian context. Indonesia has experienced a significant and continuing increase in inequality since early 2000s. Using *kabupaten* (district)-level data for the period of 2000–2012, this study is able to overcome the empirical analysis problems faced by multicountry studies. Overall, the findings indicate that consumption inequality affects growth, while education inequality seems to be more important for unemployment. In general, the impact of inequality is nonlinear in the form of inverted U-shape for growth and U-shape for unemployment. Similarly, horizontal inequality across ethnic groups is also found to have nonlinear inverted U-shape relationship with growth. Meanwhile, horizontal inequality across religious groups has a nonlinear U-shape relationship with unemployment. These findings suggest that initially inequality may not be harmful for growth and employment; however, after reaching a threshold, it will have an adverse impact. This implies that it is important to put in place policies to address increasing inequality to mitigate its harmful impact.

Keywords: inequality and growth, unemployment, district panel, Indonesia

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I. INTRODUCTION

Inequality is on the rise in Indonesia. Until 2007, Indonesia experienced a stable level of inequality, as measured by the Gini ratio using household consumption data. The Gini ratio used to fluctuate between 0.32 and 0.36. However, the ratio has increased rapidly from 0.36 in 2007 to 0.41 in 2011, which is the highest recorded in Indonesia. As a matter of fact, there is a growing concern about the current trend of rising inequality, not only in developed countries, but also in emerging and developing countries. See, for example, the inequality report 'Divided we Stand' launched by OECD in 2011, the 'Inequality Matters' report published by the UN in 2013, and several research reports published by the IMF (Berg and Ostry, 2011; Ostry et al. 2014) and the ILO (Luebker, 2012).

Whether the increase in inequality is something to be worried about or not, however, is still debatable. Some argue that inequality in income or consumption is necessary for accumulation of assets that will in turn be invested in technological advances that are necessary for long-term growth. Income inequality is also considered as the outcome of differences in "input", which is investment in human capital, particularly education, and is necessary for providing market incentive for the investment.

On the other hand, income/consumption inequality is usually closely related to other forms of inequality such as inequality in access to education, health, and public services, which in general is manifested in inequality of opportunity. These other dimensions of inequality are considered to have significant detrimental effects on economic growth and poverty reduction, and even political and social stability. Several studies worldwide show that a high level of inequality is detrimental to long-term growth and sustainable welfare improvement (see review in Perrson and Tabellini, 1994 and Benabou, 1996).

In addition to inequalities between individuals or households (vertical inequalities), inequalities between groups (horizontal inequalities) are also considered harmful to social stability. Stewart, Brown, and Mancini (2005) argue that horizontal inequality matters as people's well-being is not only affected by their individual condition but also their relative circumstances within their group. For the case of Indonesia, a study by Mancini (2005) provides empirical evidence that horizontal inequality—in the form of religious polarization—has impacted on the incidence of violent conflict.

Various research results find that the relationship between income inequality and economic growth is somewhat ambiguous. These differences are highly affected by various factors, including the correlations between income inequality and other dimensions of inequality, which in turn is often affected by government policies and programs. Therefore, it is crucial to consider not only income/consumption inequality but also other dimensions of inequality, not only vertical but also horizontal inequality.

In Indonesia, there are only limited studies looking at the issue of inequality. Most studies look at the decomposition of inequality and the sources of inequality (Booth, 2000; Akita, 2003, Yusuf et al., 2013; Miranti et al., 2013). Increasing understanding of the changes and the features of inequalities (not only income or consumption inequality but also other dimensions of inequality and not only vertical but also horizontal inequality) as well as the impact of inequality are necessary for decentralized Indonesia. Given that inequality results from and is affected by various factors, a common understanding on why it is important to tackle

inequality and what policy options are available is very important for local through to national governments as well as international communities.

In light of this, this paper aims to investigate empirically the impacts of various types of inequality on economic growth and unemployment in Indonesia. Because rising inequality is a recent phenomenon in Indonesia, there is only a short time-series data at the national level. Therefore, this study analyzes a comprehensive *kabupaten* (district)-level panel dataset from 2000 to 2012. The findings of this paper will enrich the evidence to further understand the inequality puzzle in the Indonesian as well as other developing countries' contexts.

This study is important and very relevant in at least two ways. First, despite the growing concerns about rising inequality around the globe and in Indonesia, empirical evidence on the impact of inequality on socioeconomic outcomes in Indonesia and developing countries in general is still lacking. Second, the Indonesian context provides a rich setting to address some empirical issues that plague previous studies, which are mainly based on cross-country analysis.

The paper is organized as follows. First, the following section (II) presents some theoretical frameworks and previous relevant empirical findings regarding the relationship between inequality and prosperity, notably economic growth and unemployment rates. Section III discusses in detail some measures of inequality. Section IV explores the model and the data used in this paper. We present and discuss the estimation results of the impact of inequality on growth and unemployment in Section V and their robustness checks in Section VI. Finally, Section VI brings some conclusions and offers some policy recommendations.

II. THEORETICAL FRAMEWORK AND EMPIRICAL EVIDENCE OF THE IMPACTS OF INEQUALITY ON GROWTH AND UNEMPLOYMENT

2.1 Link between Inequality and Growth

Interconnections between inequality and development, particularly economic growth, can be explained by two-way causal relationships. First, how does economic development affect inequality? The seminal work of Kuznets (1955) provides a foundation for understanding this relationship. He argues that as the economy grows inequality first increases and later decreases. This is what is referred to as Kuznets' inverted-U hypothesis.

As explained in Barro (2000), Kuznets' idea centered on the idea of workers' movements from agriculture to industry. In this model, the agricultural and rural sector initially constitutes the bulk of the economy. This sector features low per capita income and, perhaps, relatively little inequality within the sector. The industrial and urban sector starts out small, has higher per capita income and, possibly, a relatively high degree of inequality within the sector. Economic development involves a shift of workers and resources from agriculture to industry. The workers who move experience a rise in per capita income, and this change raises the economy's overall degree of inequality. Consequently, at early stages of development, the relationship between the level of per capita income and the extent of inequality tends to be positive.

As the size of the agricultural sector diminishes and industry grows, the main effect on inequality from continuing urbanization is that more of the poor agricultural workers are enabled to join the relatively rich industrial sector. This will reduce the overall inequality. Hence, at later stages of development, the relationship between the level of per capita income and the extent of inequality tends to be negative.

Based on Indonesian experience, some researchers argue that Indonesia did not follow Kuznets' prediction in its early stage of development. For three decades before the Asian financial crisis (AFC), Indonesia experienced sustained high growth while maintaining a stable Gini ratio (around 0.32 to 0.36). However, the story changed after recovering from the AFC. Even though the economy has been able to recover fairly quickly after the AFC and was quite robust in the face of the 2008 Global Financial Crisis (GFC), the Gini ratio increased rapidly reaching its highest ever peak of 0.41 in 2011 (Tadjoeddin, 2013a; 2013b).

Indonesia is actually not a unique case. Deininger and Squire (1998) point out that many countries that started with low levels of per capita income grew rapidly without an increase in inequality. On the other hand, other countries that failed to grow were not immune against possibly considerable swings in aggregate measures of inequality. In the few countries where a significant relationship emerges between growth and inequality, it contradicts the Kuznets hypothesis almost as often as confirms it.

The second causal relationship is how does inequality affect economic development? Many literature strands on the impact of inequality on economic development, mainly on economic growth, have been developed over centuries. In this section, we briefly introduce some main theories in which different paths of causation have been explored in hundreds of research papers. The main paths that have been featured are: the classical approach (saving rates), the political economy approach (redistribution), the credit market imperfections channel, the rent-seeking approach, the social unrest (political instability) approach, and the latest one is the unified theory of inequality and growth.

2.1.1 The Classical Approach

The classical approach advances the hypothesis that inequality is beneficial for growth. This theory suggests that the marginal savings rate increases with wealth by directing more income to high saving capitalists (Lewis in Easterly, 2007 and Galor, 2009; Kaldor in Easterly, 2007 and Galor, 2009). Inequality channels resources towards individuals whose marginal propensity to save is higher, results in higher aggregate savings and more capital accumulation, then increases economic growth.

The theory have been challenged in the past two decades as both later theories and empirical evidence increasingly have revealed the opposite direction of inequality impact on the growth process (see, among others, Galor and Zeira, 1993; Benabou, 1996; Aghion, Caroli, and Garcia-Penalosa, 1999) through various mechanisms. In addition to those criticisms, Venieris and Gupta (1986) also demonstrate that the bulk of savings is in fact produced by the middle income class and not by the rich.

2.1.2 The Political Economy Approach

The main theoretical hypothesis in the political economy approach is that income inequality is harmful for growth, because it leads to policies that do not protect property rights and do not

allow full private appropriation of returns from investment. High inequality will lower growth because the poor majority would vote for redistributive rather than growth-enhancing policies. Redistribution policies (taxes and transfers) are chosen by the median voter and in an unequal society the median voter is poorer than the mean. Taxes imposed on the margin are distortionary and slow growth (Alesina and Rodrik, 1994; Persson and Tabellini, 1994).

The logic of this approach, as explained in Barro (2000), is as follows: If the mean income in an economy exceeds the median income, then a system of majority voting tends to favor redistribution of resources from the rich to the poor. These taxes and transfer payments can also involve public-expenditure programs (such as education and child care) and regulatory policies that can distort economic decisions and thus lower growth. The idea is that by lowering the income of the median voter or pivotal middle class relative to the national average, greater inequality increases the pressure for redistribution. This, in turn, discourages investment and economic growth (Benabou, 1996).

However, subsequent theories have challenged the inconsistency of a negative relationship between inequality and growth in the political economy approach. An alternative mechanism has predicted a contrary hypothesis, which is a positive relationship between inequality and growth (Saint-Paul and Verdier, 1993 and 1996; Benabou, 1996; Galor and Tsiddon, 1997). For example, Saint-Paul and Verdier (1993) developed a model that predicts that in more unequal societies, the median voter will elect a higher rate of taxation to finance public education though they are not the decisive voter, which will increase aggregate human capital and economic growth.

In addition to that, Li and Zou (1998) examine both theoretically and empirically whether inequality can actually lead to higher economic growth if public consumption enters the household utility function. However, they consider a different channel that links redistribution with growth. They argue that a more equal society may lead to a higher income tax and in turn lower economic growth. On the other hand, higher inequality can actually lead to lower income taxation and thus higher growth.

2.1.3 The Credit Market Imperfections Channel

Galor and Zeira (1993) demonstrate that in the presence of credit market imperfections and fixed costs associated with investment in education, occupational choices (and thus the efficient segmentation of the labor force between skilled and unskilled workers) are affected by the distribution of income. In particular, if the interest rate for borrowers is significantly higher than that for lenders, inequality may result in an under-investment in human capital.

As large segments of the population in poor countries do not possess initial wealth, investment has to be financed through credit. Because of constraints in the credit market, many poor people cannot afford to borrow. Consequently, as education represent high initial costs which only pays off in the long run, limitations in the access to credit makes poor households forego human-capital investments, which would offer relatively high rates of return (Barro, 2000).

On the aggregate level, countries with high inequality thus invest less in human capital and are less able to benefit from technological innovations, meaning that they grow more slowly and remain poor (Galor and Zeira, 1993). Inequality may therefore adversely affect macroeconomic activity and economic development in the short-term, and due to

intergenerational transfers and their effect on the persistence of inequality, it may adversely affect economic development in the long-term as well (Galor, 2009).

2.1.4 Rent-Seeking (Institutional Mechanism)

This theory explores the situation in which the gap between rich and poor widens, and the latter may have a greater temptation to engage in rent-seeking or predatory activities at the expense of the former (Benabou, 1996). Others researchers have also proposed an institutional mechanism in which a rich elite will suppress democracy and equal rights before the law so as to preserve their privileged position. (e.g., Bourguignon and Verdier, 2000 in Easterly, 2007).

Acemoglu (2005) also has developed a model in which the oligarchy impedes democracy to maintain its privileges. Moreover, Rajan and Zingales (2006) argue that the oligarchy and the educated middle class will form a coalition against education for the uneducated poor so as to prevent both large scale reform and erosion of the rents accruing to the already educated. They, however, do not provide an empirical evidence to support their argument.

Another approach elucidates the effects of social fractionalization on growth. For example, Easterly and Levine (1997) relate growth and per capita income directly to ethnolinguistic fractionalization and find a negative relationship between them.

2.1.5 Social Unrest (Political Instability)

This theory puts its argument on the motivation of the poor to engage in crime, riots, and other disruptive activities due to the wealth and income Inequality (Barro, 2000). The stability of political institutions may even be threatened by revolution, so that laws and other rules have shorter than expected duration and greater uncertainty. The participation of the poor in crime and other antisocial actions represents a direct waste of resources because the time and energy of the criminals are not devoted to productive efforts. Moreover, threats to property rights discourage investment. Through these various dimensions of sociopolitical unrest, more inequality tends to reduce the productivity of an economy and economic growth declines accordingly.

High inequality could also lead to politically unstable institutions as power swings back and forth between redistributive populist factions and oligarchy-protecting conservative factions (Perotti, 1996; Benabou, 1996). Meanwhile, political instability itself lowers growth (Alesina et al., 1996).

2.1.6 The Unified Theory of Inequality and Growth (Human Capital Mechanism)

This theory is a form of reconciliation between the classical approach and the credit market imperfections approach. Imperfect capital markets will prevent human capital accumulation by the poor majority. On the other hand, the effect of inequality on growth depends on the relative return to both physical and human capital. Physical capital is a prime engine for growth in the early stages of industrialization but later it is substituted by human capital and relative return to physical capital decrease. Thus, the impact of inequality on growth goes from positive to negative (Galor and Zeira, 1993; Galor and Moav, 2004; Galor, 2009). In addition, assortative matching between marriage partners or other sorting also prevents human capital accumulation and in turn will result in rising inequality and decreasing growth (Fernandez; Fernandez and Rogerson in Easterly, 2007).

2.2 Link between Inequality and Unemployment

In contrast to the relationship between inequality and growth that has been hotly debated for decades, discussions on the link between inequality and unemployment are rather scant. Furthermore, the few available studies discuss only the impact of unemployment on inequality. We could not find studies that examine the other impact in the other direction.

On the other hand, today in real life we see that a major consequence of high and persistent unemployment is increasing social discontent and the risk of social unrest, which, according to the World of Work report (ILO, 2011), is largely motivated by inequality. In fact, it is clear in some regions such as Eastern Europe and Central Asia that high and persistent unemployment is related not only with higher poverty rates, but also with higher inequality, since the unemployed lose proportionally more than the employed (Nickell, 1990 in Castells-Quintana and Royuela, 2012). However, this may be less clear for the case of Indonesia since unemployment does not necessarily relate to poverty. The poor need to work even harder to meet their basic needs.

Castells-Quintana and Royuela (2012) argue that the factors that provide the theoretical base to expect that high and persistent unemployment reduces growth seem to be closely associated to inequality. Furthermore, they argue that unemployment is likely to lead to increasing inequality. Therefore, they find that the negative impact of high unemployment rates on long-run growth will be more relevant when high and persistent unemployment is linked to increasing inequality.

Leibbrandt et al. (n.d.) elaborates on the employment and inequality situation in South Africa. It is well-known that income has become increasingly concentrated in the top income deciles at the expense of all other deciles in post-apartheid South Africa. This discrepancy is reinforced by the fact that labor force participation rates are highest in the top income deciles, which also have the highest labor absorption rates. Therefore, it is relatively clear that income source decompositions identify the labor market as the leading factor driving inequality in South Africa.

In addition to income inequality, education inequality among racial groups in South Africa could also explain high levels of unemployment amongst Africans, as well as their lower average wages. Education policy under apartheid was starkly inequitable across people of different races. The majority of state resources were diverted to schools in "white" areas, while the population living in "black" areas was subjected to very low quality schooling. Despite massive shifts in the allocation of state resources, educational inequalities have proven to be remarkably persistent. Inequality in quality of education also becomes another major problem, particularly for Africans. Hence, low skill levels result in low wages and become a barrier to employment, which reinforces the vicious cycle of poverty and inequality.

III. MEASURES OF INEQUALITY

As mentioned earlier in the introduction, inequality has many dimensions. Income or consumption inequality is one of the inequality measures that have received the most attention from economists. However, income or consumption inequality shall not be assumed as the one and only measure. There are potential non-income or non-economic measures of

inequality we should consider as important as income or other economic inequality that have significant impact on socioeconomic development, people's well-being and status, and even political and social stability.

In addition to that, most existing discussions and concerns about inequality measurement concentrate on vertical inequality, or inequality among individuals. We tend to ignore another important measure, called horizontal inequality that appraises inequalities between groups. Stewart, Brown, and Mancini (2005) argue that horizontal inequality matters as people's well-being is not only affected by individual condition but also their relative circumstances within their group.

Group inequality can be both important instrumentally for achieving other objectives and in itself. Three instrumental reasons are offered in the literature: (i) reducing group inequality promotes efficiency, and means that any system in which one group is discriminated against is likely to be less efficient than in the absence of discrimination since talented people in the discriminated group will be held back, and less talented people from the favored group will get resources or positions; (ii) group inequality can be a source of violent conflict, which means that leaders can have powerful grievances to mobilize people to engage in political protest if group inequality and group exploitation exist; (iii) group inequality may facilitate a more effective targeting; it might be difficult to improve individuals' position or well-being without considering their group position (Stewart, Brown, and Mancini, 2005).

Considering the importance of alternative measurements of inequality, in this paper we introduce several dimensions of inequality, not only the dimension of income/consumption but also education inequality (in terms of mean years of schooling), and also take into account both inequality among individuals (vertical inequality) as well as inequality between groups (horizontal inequality).

We use the traditional Gini ratio of consumption to measure the vertical inequality at the *kabupaten* level. Furthermore, we add another dimension of non-economic inequality, i.e., Gini ratio of education, measured in terms of mean years of schooling. Following Stewart, Brown, and Mancini (2005), the Gini ratio is formulated in Equation (1).

$$GINI = \frac{1}{2n^2\bar{y}}\sum_{i}^{n}\sum_{j}^{n}|y_i - y_j| \quad (1)$$

y_i: the expenditure/mean years of schooling (education) of individual i
y_j: the expenditure/mean years of schooling (education) of individual j
$\bar{y}$: the sample mean of expenditure/mean years of schooling (education)
n : the sample size

The Gini ratio has an advantage that it compares every individual with every other and does not square the differences. It is especially sensitive to the middle of distribution.[1]

Meanwhile, for horizontal inequality, we use two measures: group Gini (GGINI) and weighted group coefficient of variation (WGCOV). The horizontal inequality measures group

[1]There are other popular measures of vertical inequality such as the Theil indices. Here, we focus on Gini Ratio as it is officially used to measure inequality in Indonesia.

people based on their characteristics such as religion, ethnicity, language, race, rural-urban location, etc. and then compares welfare conditions across groups within a characteristic. Both of the GGINI and the WGCOV in this paper group people based on religion and ethnicity and measure inequality in the educational dimension, proxied by mean years of schooling, also at the *kabupaten* level.[2] In addition, we also measure spatial inequality using group Gini *kecamatan* (subdistrict) based on the mean years of schooling by *kecamatan*.

Also following Stewart, Brown, and Mancini (2005), the group Gini is formulated in Equation (2), while the Weighted Group Coefficient of Variation is formulated in Equation (3).

$$GGINI = \frac{1}{2\bar{y}} \sum_{r}^{R} \sum_{s}^{S} p_r p_s |\bar{y}_r - \bar{y}_s| \tag{2}$$

$\bar{y}$: the sample mean of mean years of schooling (education)
p_r: the ethnicity/religion group r population share
p_s: the ethnicity/religion group s population share
$\bar{y}_r$: the mean of mean years of schooling (education) of group r
$\bar{y}_s$: the mean of mean years of schooling (education) of group s

$$Weighted\ GCOV = \frac{1}{\bar{y}} \left(\sum_{r}^{R} p_r (\bar{y}_r - \bar{y})^2 \right)^{\frac{1}{2}} \tag{3}$$

$\bar{y}$: the sample mean of mean years of schooling (education)
p_r: the ethnicity/religion group r population share
$\bar{y}_r$: the mean of mean years of schooling (education) of group r

The WGCOV in principle is the standard deviation divided by the mean weighted by the size of the population. The coefficient of variation involves squaring the deviations from the mean, thus put more weight to the extremes. It only measures differences from the mean, not every difference with every other group. However, the WGCOV has the advantage that it is less sensitive to variation in the number of religious/ethnic groups across *kabupaten*.

IV. THE MODEL AND THE DATA

To investigate the relationships between inequality and prosperity variables (with proxies of growth and unemployment), we mainly draw the model from the existing literature. Cross-country literatures (Perrson and Tabellini, 1994; Perotti, 1996; Deininger and Squire, 1998;

[2]We do not include consumption in the horizontal inequality measure because consumption variable is not available in the Population Census data.

Barro, 2000; Forbes, 2000) employ a limited dependent variable model to investigate the link between inequality and growth. Perotti (1996) estimates growth as a function of initial inequality, income, male and female human capital, and market distortions. Forbes (2000) replicates Perotti's model and adds country and time dummy variables in her country-panel dataset. The country dummy variable is used to control for time-invariant omitted-variable bias, while the time dummy variable is included to control for global shocks which might have an impact on growth in any time period but not captured by the explanatory variables in the model.

In their empirical model, Perrson and Tabellini (1994) put per capita growth as their dependent variable, while for the independent variables they use income distribution of the top 20 per cent of the population as a function of inequality, political participation to control the median voter that could influence redistribution policy in the country, average skills of the young generation as well as the variables that measure the level of development of the country.

Barro (2000) estimates a panel regression of growth rate on Gini and controlled by log per capita GDP, as well as an array of policy variables such as government consumption/GDP, rule of law index, democracy index (electoral rights), and the rate of inflation. He also included human capital measures such as years of schooling, total fertility rate, as well as the ratio of investment to GDP, and lastly, the growth rate of terms of trade.

However, it is obvious that the use of cross-country data for assessing empirical relationships between inequality and growth faces some econometric issues. The first is measurement error. The definition of key variables may vary between countries, the accuracy of data collection also influences the reliability and validity of the data. Though some authors claim that they employ high quality inequality data (Deininger and Squire, 1998; Forbes 2000), a concern over low quality inequality data is still valid for some countries, especially developing and poor countries. The second problem is omitted-variable bias that causes the bias in the coefficient estimates and standard errors. The bias is resulted from any variables that actually explain growth and not correlated with any of the regressors but are not included in the regression.

Some efforts have been made to address the empirical challenges that plague the cross-country analysis (Ravallion 1998, Balisacan and Fuwa undated, Qin et al., 2009, Benjamin et al. 2011). One of those is to exploit country-level setting to permit the same definitions of key variables in the regressions, thus reduce the measurement errors. It also permits better isolation of the impact of the inequality from unobserved factors, while at the same time, provide some spatial differences between regions or other unit of observations in the country.

In the light of this, we try to address these two crucial empirical issues in the inequality and growth nexus by exploiting a rich panel dataset of all *kabupaten* in Indonesia during 2000–2012. In other words, we replicate cross-country analysis as in the previous works to the *kabupaten*-level setting over a 12-years period. Measurement error could be minimized by using this approach because we examine the same data sources and definitions across *kabupaten*. Moreover, using a panel instead of standard cross-section data is another method of reducing omitted-variable bias in the regressions.

A set of control variables that is assumed to help explain the *kabupaten* growth are also included in our model in addition to the main explanatory variables as in the previous work on cross-country analysis. These consist of variables which proxy the economic development, population and demographic characteristics, as well as geography-related conditions at the *kabupaten* level (see Table 1 for details).

Our main model (Equation 4) estimates growth and unemployment in the current period as a function of inequality in the previous period, controlled by regional per capita income, male and female human capital, and other control variables representing the level of *kabupaten* economic development and population, all in the previous period, and also geography, represented by island dummy variables. The variables are listed and defined in Table 1. To estimate the models, we use the ordinary least squares (OLS) method.

$$g_{it} = \beta_1 Inequality_{i,t-1} + \beta_2 Income_{i,t-1} + \beta_3 MaleEducation_{i,t-1} + \beta_4 FemaleEducation_{i,t-1} + \sum_{j}^{k} \beta_j X_{i,t-1} + island\ dummy_i + u_{it} \quad (4)$$

In equation (4), i represents each *kabupaten* and t represents time period; g_{it} is average annual *kabupaten* total growth for *kabupaten* i during period t or average *kabupaten* unemployment rate for *kabupaten* i during period t; $\text{Inequality}_{i,t-1}$ is vertical inequality (consumption or education Gini ratio) in the previous period or initial horizontal inequality (GGINI or WGCOV based on religion/ethnicity or GGINI *kecamatan*) for *kabupaten* i during period t; $Income_{i,t-1}$ is average per capita *kabupaten* gross regional domestic product (GRDP) in the previous period; $\text{MaleEducation}_{i,t-1}$ and $\text{FemaleEducation}_{i,t-1}$ are average male and female mean years of schooling in the previous period; $X_{i,t-1}$ is a set of other control variables for *kabupaten* i in the previous period; and u_{it} is the error term. We also include a demographic fractionalization (religion and ethnic fractionalization) as another independent variable in the model; this variable is used as a substitute of horizontal inequality measure in separate regressions.[3]

In addition to the linear model, we also exploit a nonlinear model which involves squaring the inequality variables. This is inspired by Banerjee and Duflo (2003), who mention the possibility of nonlinear relationship between inequality and growth rates in cross-country data.

The unit of observation in this model is *kabupaten* level using a *kabupaten*-level panel data-set with annual observation for the period of 2000 to 2012. Because many new *kabupaten* were established during this period, all datasets are realigned to match the 2000 *kabupaten* borders. The list of final data set, including the sources of the data, is reported in Table 1 and the descriptive statistics of key variables are available in Appendix 1.

[3]Fractionalization is measured as $F = 1 - \sum_j^J p_r^2$, where $p_r$is group r's population share. We also define a binary variable of heterogeneity (=1 if fractionalization (Fe or Fr)>0.1; otherwise).

Table 1. Variable Definitions and Sources of Data

List of Variables	Definition	Source of Data
Dependent variables		
Economic growth	*Kabupaten* GRDP growth	BPS
Unemployment	*Kabupaten* unemployment rate	Susenas 00-12
Independent variables		
Vertical inequalities	Consumption inequality measures	Susenas 2000-2012
	Education inequality measures (years of schooling)	Susenas 2000-2012
Horizontal inequalities	Religious group inequality measures (mean of key variable by religious group). The key variable is years of schooling	Population Census 2000 & 2010
	Ethnic group inequality measures (mean of key variable by ethnic group). The key variable is years of schooling	Population Census 2000 & 2010
	Spatial group inequality measures (mean of key variable by *kecamatan*). The key variable is years of schooling	Population Census 2000 & 2010
Fractionalization	Fractionalization based on ethnicity (Fe), fractionalization based on religion (Fr), heterogeneity based on ethnicity (heteroe), and heterogeneity based on religion (heteror)	Population Census 2000 & 2010
Control Variables		
Economic development		
Log GRDP per capita	*Kabupaten* Log per Capita Gross Regional Domestic Product (GRDP)	Susenas and *Kabupaten* GRDP 2000-2012
Initial unemployment rate (only in employment model)	Unemployment rate in *kabupaten* level	Susenas 2000-2012
Asphalt road	Share of villages with asphalt main road in a *kabupaten*	Podes 2003, 2005, 2008, 2011
Electricity	Number of households with electricity in a *kabupaten*	Podes 2003, 2005, 2008, 2011
Poverty rate	Poverty rate *kabupaten*	BPS Poverty Data and Publications
Population		
Log population size	Log population *kabupaten*	Susenas 2000-2012
Proportion of young people	Proportion of population 16-24 years old in a *kabupaten*	Susenas 2000-2012
Female years of schooling	Mean years of schooling in a *kabupaten*: Female	Susenas 2000-2012
Male years of schooling	Mean years of schooling in a *kabupaten*: Male	Susenas 2000-2012
Geography		
Dummy island	Dummy variable of the major island where a *kabupaten* is located	Susenas 2000-2012
Mountainous area	Percentage of villages in mountainous area in a *kabupaten*	Podes 2003, 2005, 2008, 2011

V. ESTIMATION RESULTS

5.1 Inequality and Growth

5.1.1 Vertical Inequality

To measure the impact of inequality on growth, we first split our dataset into two periods (2000–2005 and 2006–2011) and construct the variables of average of subsequent growth (2006–2011) and initial vertical inequality (2000–2005) at the *kabupaten* level as the main dependent and independent variables. This approach mitigates the effect of transitory (contemporaneous) shocks and measurement errors in the model estimation.

The main estimation results from the growth model are presented in Table 2. It shows that three out of the four models estimated have no significant inequality coefficients. The exception is specification (3), which is the nonlinear model of consumption inequality. This model implies that initially an increase in inequality increases growth, but after reaching the peak point, further increase in inequality reduces growth. However, only the coefficient of Gini ratio is statistically significant, while the coefficient of Gini ratio square is not significant.

The implied peak point of Gini ratio from the coefficients is 0.3. Meanwhile, Appendix 1 shows that the average Gini ratio of all *kabupaten* during 2000–2012 is 0.29. Since inequality has continued to increase during the period, this implies that now Indonesia has already passed the peak point and the impact of inequality on growth is in the negative trajectory.

To check if different period splitting will give different results, we replicate Benjamin, Brandt, Giles (2010) for China's case, in which they run the model using different beginning and end points. This exercise could also give us an idea about the relationship between inequality and growth over time. We divide the period into four equal length sub-periods: 2000-2002, 2003-2005, 2006-2008, and 2009-2011. We estimate the models using the same covariates as in the main models in Table 2. The results are summarized in Table 3 for consumption inequality and Table 4 for education inequality.

Table 2. How Initial Vertical Consumption Inequality (2000–2005) Relates to Subsequent Growth (2006–2011)

	Linear Model		Nonlinear Model	
	(1)	(2)	(3)	(4)
gini0005	0.043		0.976*	
	(0.052)		(0.553)	
gini0005^2			-1.658	
			(1.019)	
edugini0005		-0.068		2.218
		(0.116)		(1.995)
edugini0005^2				-6.968
				(6.018)
lpcgrdp0005	-0.014***	-0.014***	-0.013***	-0.014***
	(0.005)	(0.005)	(0.005)	(0.005)
unemployment0005	0.005	0.002	-0.015	0.007
	(0.052)	(0.052)	(0.051)	(0.054)
p00005	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
lpopulasi0005	0.000	0.000	0.000	0.000
	(0.002)	(0.002)	(0.002)	(0.002)
asphaltroad0005	-0.007	-0.006	-0.007	-0.005
	(0.008)	(0.008)	(0.008)	(0.008)
yearofschoolm0005	0.010*	0.011*	0.010*	0.011*
	(0.006)	(0.006)	(0.006)	(0.006)
yearofschoolf0005	-0.005	-0.005	-0.004	-0.006
	(0.005)	(0.005)	(0.005)	(0.005)
young0005	-0.044	-0.040	-0.031	-0.040
	(0.036)	(0.034)	(0.037)	(0.034)
mountain0005	-0.022***	-0.022***	-0.022***	-0.021***
	(0.007)	(0.007)	(0.007)	(0.007)
_cons	0.047	0.064	-0.086	-0.121
	(0.037)	(0.051)	(0.089)	(0.166)
Island dummy	Yes	Yes	Yes	Yes
R-sq	0.201	0.200	0.209	0.202
N	287	287	287	287

Note: Robust standard errors in parentheses.

*10% significant.

**5% significant.

***1% significant.

Table 3. How Initial Consumption Inequality Relates to Subsequent Growth

Beginning Period		Endpoint Period					
		2003–2005		2006–2008		2009–2011	
		Linear	Nonlinear	Linear	Nonlinear	Linear	Nonlinear
2000–2002	Gini	0.032	0.213	0.045	0.872	0.077	0.837
	Gini^2		-0.327		-1.494		-1.372
2003–2005	Gini			0.043	0.401	0.068	0.421
	Gini^2				-0.625		-0.614
2006–2008	Gini					-0.006	1.017
	Gini^2						-1.69

Notes: the reported numbers are the coefficients of the effect of inequality on growth with the same covariates as in Table 2.
*10% significant
**5% significant
***1% significant

Table 4. How Initial Education Inequality Relates to Subsequent Growth

Beginning Period		Endpoint Period					
		2003–2005		2006–2008		2009–2011	
		Linear	Nonlinear	Linear	Nonlinear	Linear	Nonlinear
2000–2002	Edugini	0.314*	1.127	0.012	0.992	0.23	5.049**
	Edugini^2		-2.469		-2.979		-14.648*
2003–2005	Edugini			-0.141	-0.971	-0.075	1.669
	Edugini^2				2.57		-5.399
2006–2008	Edugini					-0.23	2.77
	Edugini^2						-8.942

Notes: the reported numbers are the coefficients of the effect of inequality on growth with the same covariates as in Table 2.
*10% significant.
**5% significant.
***1% significant.

Table 3 shows that most coefficients have the signs that are consistent with the main results in Table 2, i.e. positive in the linear models and inverted U-shape in the nonlinear models. However, none of the coefficients are statistically significant, suggesting that breaking the period into shorter periods dilutes the impact of inequality on growth. This implies that only if the increase in inequality is sustained for a sufficiently long period will its impact on growth become significant.

Interestingly, for education inequality, using 2000–2002 as the beginning point, we find a positive linear impact on growth in the immediate subsequent period of 2003–2005. The impact then disappeared in the following period (2006–2008), but appeared again in the 2009–2011 period in a nonlinear (inverted U-shape) form. The implied peak point of education inequality from the coefficients is a Gini ratio of 0.175, while the mean is 0.173. Since 2000–2002 is the recovery period following the Asian financial crisis (AFC), these results seem to suggest that marked differences in education levels in society is beneficial for pushing growth in a recovery period, but its latent impact in the long term is an inverted U-shape.

5.1.2 Horizontal Inequality

Table 5 summarizes the estimation results of the effects of fractionalization and horizontal inequalities on economic growth. We use horizontal inequality in 2000 as the main independent variable and subsequent long-term growth (geometric mean 2001–2012) as the dependent variable. We also estimate the impact of horizontal inequality in 2000 to subsequent growth in shorter period of time (2001–2006) to check if there are differences between shorter and longer period impacts. We estimate the models using the same covariates as in Table 2.

The results show that the initial ethnic fractionalizations seem to have positive linear impact on subsequent growth both in shorter and long-term subsequent growth. The coefficient of heterogeneity is also positive and significant, indicating that higher heterogeneity at the *kabupaten* level is associated with higher subsequent growth. However, for both measures of initial horizontal inequality across ethnic groups (WGCOVe and GGINIe), there are significant nonlinear (inverted U-shape) relationships between initial inequality in 2000 and subsequent economic growth during 2001–2012.

For inequality across religious groups, there are only significant linear relationships between initial heterogeneity of the *kabupaten* and the subsequent growth both in shorter and longer-term periods. However, we find no significant relation between religious fractionalization as well as initial horizontal inequality both measured by GGINI and WGCOV in 2000 and subsequent economic growth during 2001-2012 and 2001-2006.

Finally, the estimation results show a significant nonlinear (U-shaped) relationship between initial spatial inequality (as measured by group Gini *kecamatan* in 2000) and subsequent long term growth during 2001–2012. Thus this also indicates that inequality within and between *kecamatan* in one *kabupaten* first reduces long-term subsequent *kabupaten* growth then increases the *kabupaten* growth. This suggests that *kabupaten* with differing levels of development across *kecamatan* have higher growth rates than *kabupaten* with more equal *kecamatan*, perhaps because the left behind *kecamatan* grow faster in order to catch up with their neighbors.

Table 5. How Initial Fractionalization and Horizontal Inequalities Relate to Long-Term Subsequent Growth

HI Variables 2000		Subsequent Growth 2001–2012		Subsequent Growth 2001–2006	
		Linear	Nonlinear	Linear	Nonlinear
ethnicity	Fe	0.109***	0.061	0.127***	0.163*
	Fe^2		0.059		-0.044
	Heteroe	0.034***		0.048***	
	W_GCOVe	0.067	0.022	0.078	0.235**
	W_GCOVe^2		0.066		-0.230**
	GGINIe	0.271	0.451**	0.391*	0.792***
	GGINIe^2		-0.784		-1.750**
religion	Fr	0.056	0.004	0.063	-0.061
	Fr^2		0.089		0.216
	Heteror	0.033**		0.031*	
	W_GCOVr	-0.160	-0.456	-0.067	0.026
	W_GCOVr^2		0.653*		-0.204
	GGINIr	-0.403	-0.185	0.110	0.256
	GGINIr^2		-1.67		-1.109
spatial	GGINIk	-0.194	-0.723*	0.099	0.292
	GGINIk^2		1.529*		-0.559

Notes: the reported numbers are the coefficients of the effect of horizontal inequality on growth with the same covariates as in Table 2.
*10% significant.
**5% significant.
***1% significant.

5.2 Inequality and Employment

5.2.1 Vertical Inequality

We now turn to see the estimation results for the unemployment model. The main results are presented in Table 6. As in the growth model, we split our dataset into two periods (2000–2005 and 2006–2011) and construct the average of initial vertical inequality (2000–2005) and subsequent unemployment rate (2006–2011). The results indicate that there is no significant relationship between initial consumption Gini and subsequent unemployment rate.

However, there is a significant nonlinear relationship (U-shape) between the initial education Gini and subsequent unemployment. At first, an increase in initial education Gini reduces unemployment rate in the subsequent period, but after the peak point, further increase in education inequality increases unemployment. The coefficients imply that the peak point is 0.17, which coincides with the mean of education Gini ratio across *kabupaten* during 2000–2012. There are no coefficients of control variables which are significant, except the initial unemployment rate and proportion of the youth population.

Table 6. How Initial Vertical Education Inequality (2000–2005) Relates to Subsequent Unemployment Rate (2006–2011)

	Linear Function		Nonlinear Function	
	(1)	(2)	(3)	(4)
gini0005	-0.038		0.306	
	(0.027)		(0.248)	
gini0005_2			-0.611	
			(0.433)	
edugini0005		0.012		-2.792**
		(0.08)		(1.328)
edugini0005_2				8.549**
				(4.121)
lpcgrdp0005	0.001	0.001	0.002	0.001
	(0.002)	(0.002)	(0.002)	(0.002)
unemployment0005	0.486***	0.488***	0.479***	0.482***
	(0.04)	(0.041)	(0.041)	(0.041)
p00005	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
lpopulasi0005	0.001	0.001	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)
asphaltroad0005	0.001	0.000	0.001	0.000
	(0.004)	(0.004)	(0.004)	(0.004)
yearofschoolm0005	-0.002	-0.002	-0.002	-0.002
	(0.003)	(0.003)	(0.003)	(0.003)
yearofschoolf0005	0.002	0.002	0.002	0.003
	(0.003)	(0.003)	(0.003)	(0.003)
young0005	0.056***	0.053**	0.061***	0.052**
	(0.022)	(0.021)	(0.022)	(0.021)
mountain0005	0.003	0.003	0.003	0.002
	(0.004)	(0.004)	(0.004)	(0.004)
_cons	-0.009	-0.015	-0.058	0.212**
	(0.018)	(0.025)	(0.039)	(0.106)
Island dummy	Yes	Yes	Yes	Yes
R-sq	0.68	0.678	0.682	0.684
N	287	287	287	287

Note: The numbers below the coefficients are robust standard errors.
*10% significant.
**5% significant.
***1% significant.

As in the case with consumption inequality, to check if different period splitting will give different results, we re-estimate the model using different beginning and end points. We estimate the models using the same covariates as in the main models for unemployment in Table 6. The results are presented in Table 7 for consumption inequality and Table 8 for education inequality.

Table 7. How Initial Consumption Inequality Relates to Subsequent Unemployment

Beginning Period		Endpoint Period					
		2003–2005		2006–2008		2009–2011	
		Linear	Nonlinear	Linear	Nonlinear	Linear	Nonlinear
2000-2002	Gini	-0.040	0.494	-0.085*	0.560	-0.065**	0.569**
	Gini^2		-0.965		-1.166*		-1.144**
2003-2005	Gini			-0.025	0.225	-0.005	0.214
	Gini^2				-0.436		-0.383
2006-2008	Gini					-0.019	0.162
	Gini^2						-0.299

Notes: The reported numbers are the coefficients of the effect of inequality on growth with the same covariates as in Table 6
*10% significant.
**5% significant.
***1% significant.

Table 8. How Initial Education Inequality Relates to Subsequent Unemployment

Beginning Period		Endpoint Period					
		2003–2005		2006–2008		2009–2011	
		Linear	Nonlinear	Linear	Nonlinear	Linear	Nonlinear
2000-2002	Edugini	-0.063	-1.554	-0.049	-4.394**	-0.080	-2.701*
	Edugini^2		4.534		13.210**		7.969*
2003-2005	Edugini			0.112	-2.283**	-0.029	-2.444**
	Edugini^2				7.415**		7.474**
2006-2008	Edugini					-0.019	0.162
	Edugini^2						-0.299

Notes: the reported numbers are the coefficients of the effect of inequality on growth with the same covariates as in Table 6.
*10% significant.
**5% significant.
***1% significant.

Table 7 shows that using 2000–2002 as the beginning point, there is a negative and significant linear relationship between initial consumption Gini ratio and subsequent unemployment rates in 2006–2008 and 2009–2011. In the nonlinear model, there is an inverted-U shape relationship between initial consumption Gini ratio in 2000–2002 and subsequent unemployment rates in 2006–2008 and 2009–2011, although only the coefficient of the square term which is significant in the former period.

The results for education inequality in Table 8, however, confirm that it has a U-shape relationship with the unemployment rate over both medium and long terms. The 2000–2002 and 2003–2005 beginning points have significant relationships with the 2006–2008 and 2009–2011 end points.

5.2.2 Horizontal Inequality

A summary of the estimation results of the effects of fractionalization and horizontal inequalities on economic growth is presented in Table 9. We use initial horizontal inequality in

2000 as the main independent variable and subsequent long-term unemployment rates (geometric mean 2001–2012) and subsequent short-term unemployment rates (2001–2006) as the dependent variables.

The results show that horizontal inequality across ethnic groups has a significant nonlinear (inverted U-shape) relationship with subsequent unemployment in both the short and long-term. Meanwhile, initial fractionalization and heterogeneity across ethnic groups has no significant relationship with subsequent unemployment.

For horizontal inequality across religious groups, the estimation results of the linear models suggest a negative relationship with long-term and short-term subsequent unemployment. However, the estimation results of the nonlinear models suggest that the relationship is U-shaped with subsequent unemployment both in the long-term and short-term. At first, horizontal inequality across religious groups reduces unemployment rates, but after reaching the peak point, it increases unemployment.

Meanwhile, the results for spatial inequality indicate that there is a nonlinear inverted U-shape relationship between spatial inequality across *kecamatan* with *kabupaten* unemployment rates in both short and long-terms. Higher inequality across *kecamatan* initially reduces *kabupaten* unemployment, but after reaching the peak, it increases the unemployment rates.

Table 9. How Initial Fractionalization and Horizontal Inequalities Relate to Long-Term Subsequent Unemployment

HI variables 2000		Subsequent Unemployment 2001–2012		Subsequent Unemployment 2001–2006	
		Linear	Nonlinear	Linear	Nonlinear
ethnicity	Fe	0.001	0.021	-0.002	0.014
	Fe^2		-0.024		-0.019
	Heteroe	0.001		-0.001	
	W_GCOVe	-0.018	0.023	-0.023	0.022
	W_GCOVe^2		-0.060***		-0.067**
	GGINIe	-0.021	0.084**	-0.035	0.080
	GGINIe^2		-0.458***		-0.503***
religion	Fr	-0.009	-0.059***	-0.020**	-0.085***
	Fr^2		0.087**		0.113**
	Heteror	-0.003		-0.006*	
	W_GCOVr	-0.056***	-0.050	-0.086***	-0.097**
	W_GCOVr^2		-0.012		0.023
	GGINIr	-0.088*	-0.251**	-0.162***	-0.343**
	GGINIr^2		1.251		1.380
spatial	GGINIk	-0.025	0.074*	-0.038	0.058
	GGINIk^2		-0.286***		-0.278**

*10% significant.

**5% significant.

***1% significant.

VI. ROBUSTNESS CHECKS

The first robustness checks consider whether our results are robust to the period of observations. There are two reasons why this is important: (i) The 2000–2002 period is an early recovery period after the Asian financial crisis (AFC), where the level of inequality was relatively low. The robustness checks are to ensure that our results are not driven by the first couple of recovery years by checking whether we get the same results if we use 2003 data as our first start; and (ii) There are some adjustments and changes in the methodology of Susenas starting in 2011. The robustness checks in this case are to ensure whether we get the same results if we end the period at 2010.

Hence, the robustness checks are implemented by estimating two different beginning and end periods. The first is to estimate the model with control and island dummy using average initial inequality in 2000–2005 and average subsequent growth and unemployment in 2006–2010. The second is to estimate the model with control and island dummy using average initial inequality in 2003–2006 and average subsequent growth and unemployment in 2007–2010. The results for the growth models are presented in Table 10 and 11 and for employment models in Table 12 and 13.

Table 10. Robustness Check for the VIs—Growth Model (1)

Initial Inequality (avg. 2000–2005)	Average Subsequent Growth 2006–2010	
Gini	0.065	0.989*
Gini^2		-1.642*
Edugini	-0.063	2.224
Edugini^2		-6.975

*10% significant.
**5% significant.
***1% significant.

Table 11. Robustness Check for the VIs—Growth Model (2)

Initial Inequality (avg. 2003–2006)	Average Subsequent Growth 2007–2010	
Gini	0.079**	0.394
Gini^2		-0.547
Edugini	-0.058	1.233
Edugini^2		-3.965

*10% significant.
**5% significant.
***1% significant.

Table 12. Robustness Check for the VIs—Unemployment Model (1)

Initial Inequality (avg. 2000–2005)	Average Subsequent Unemployment 2006–2010	
Gini	-0.039	0.327
Gini^2		-0.651
Edugini	0.015	-2.570*
Edugini^2		7.880*

*10% significant.
**5% significant.
***1% significant.

Table 13. Robustness Check for the VIs—Unemployment Model (2)

Initial Inequality (avg. 2003–2006)	Average Subsequent Unemployment 2007–2010	
Gini	0.011	0.425**
Gini^2		-0.721*
Edugini	0.018	-1.357
Edugini^2		4.225

*10% significant.
**5% significant.
***1% significant.

The results of the robustness check for growth show that there is a significant inverted U-shape relationship between initial consumption inequality in 2000–2005 and subsequent growth in 2006–2010, as found in the previous main results. However, the effect of consumption Gini does not come up significantly in the another nonlinear model using beginning point 2003–2006 and end point 2007–2010. Rather, Table 12 indicates that there is a significant positive relationship between inequality in 2003–2006 and subsequent growth in 2007-2010.

For the unemployment models, the results of the robustness checks in Table 12 show consistency with the previous main results. Moreover, the coefficient magnitudes are also similar. On the contrary, the results in Table 13 are different from the previous main results. There is an inverted U-shape relationship between consumption Gini ratio in 2003–2006 with subsequent employment in 2007–2010. However, there is no significant relationship between education Gini in 2003–2006 and subsequent unemployment in 2007–2010.

The results in Tables 10 and 12 show that the main results are robust to the exclusion of 2011–2012 end period. However, Tables 11 and 13 indicate that the results are less robust to the exclusion of 2000–2002 initial period. This implies that in assessing the impact of inequality, it is important to take into account the context when changes in inequality occur. The 2000–2002 period in Indonesia is an early recovery period from a crisis where the level of inequality is relatively low.

The second robustness check is to utilize the panel nature of the data and use alternate estimation methods using *kabupaten*/province/island fixed effects and random effects. The difference between those two methods is the information used to calculate the coefficients.

The fixed effects calculate differences within each *kabupaten*/province/island across time while the random effects calculate all information across observations and across time. The random effects are more efficient but they are consistent only if *kabupaten*/province/island effects are uncorrelated with the other explanatory variables (Forbes 2000).

To smooth out the data, we first calculate three-yearly averages of all the variables. To deal with endogeneity problem, we estimate the models using lag dependent variables. Finally, we estimate separate regressions to test whether the impacts are different between *kabupaten*, province, and island level fixed and random effects. The results are shown in Table 14 for consumption inequality and Table 15 for education inequality. In these robustness checks, we only estimate the growth models.

The results in Table 14 show that the only significant coefficients of lag of consumption Gini ratio are with island and province level random-effects in nonlinear (inverted U-shape) models. The results of Hausman tests; however, reject the assumption required for random effects, indicating that fixed-effects are the preferred models.[4] Meanwhile, the results for education inequality in Table 15 produce no significant coefficients of lag of education Gini ratio in all specifications (linear and nonlinear) and in all levels (island/province/*kabupaten*) of fixed and random effects. Overall, these results indicate that the main models are preferable to the alternative models.

[4]For nonlinear island level-random effect model, the test statistics is chi2(10) = 20.97 which rejects the null hypothesis at 5% level of significance. For nonlinear province level-random effect model, the test statistics is chi2(10)=18.97 which rejects the null hypothesis at 10% level of significance.

Table 14. Fixed Effects and Random Effects Estimations of Growth Models with Consumption Inequality

Initial Inequality (avg. 3 years)	Subsequent Growth (average 3 years)											
	Island				Province				*Kabupaten*			
	FE		RE		FE		RE		FE		RE	
	Linear	Non-Linear	Linear	Non-Linear	Linear	Non-Linear	Linear	Non-Linear	Linear	Non-Linear	linear	Non-linear
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
L.gini	-0.036	0.365	0.037	0.633*	-0.036	0.358	-0.005	0.656*	-0.036	0.358	-0.036	0.358
	(0.062)	(0.485)	(0.041)	(0.348)	(0.062)	(0.485)	(0.043)	(0.373)	(0.062)	(0.485)	(0.062)	(0.485)
L.gini2		-0.693		-1.036*		-0.682		-1.149*		-0.682		-0.682
		(0.834)		(0.601)		(0.832)		(0.643)		(0.832)		(0.832)
L.pcgrdp	0.000	0.001	-0.001***	-0.001***	0.000	0.001	-0.001***	-0.001***	0.000	0.001	0.000	0.001
	(0.001)	(0.001)	(0.000)	(0.000)	(0.001)	(0.001)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)
L.unemployment	-0.180***	-0.176**	-0.126***	-0.129***	-0.180***	-0.176**	-0.164***	-0.164***	-0.180***	-0.176**	-0.180***	-0.176**
	(0.068)	(0.069)	(0.042)	(0.042)	(0.068)	(0.069)	(0.045)	(0.045)	(0.068)	(0.069)	(0.068)	(0.069)
L.asphaltroad	0.046**	0.046**	0.005	0.005	0.046**	0.046**	0.011	0.011	0.046**	0.046**	0.046**	0.046**
	(0.019)	(0.019)	(0.008)	(0.008)	(0.019)	(0.019)	(0.008)	(0.008)	(0.019)	(0.019)	(0.019)	(0.019)
L.yosf	-0.004	-0.004	-0.001	-0.001	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004
	(0.009)	(0.009)	(0.004)	(0.004)	(0.009)	(0.009)	(0.005)	(0.005)	(0.009)	(0.009)	(0.009)	(0.009)
L.yosm	0.001	0.001	0.004	0.004	0.002	0.002	0.007	0.007	0.002	0.002	0.002	0.002
	(0.009)	(0.009)	(0.004)	(0.004)	(0.009)	(0.009)	(0.005)	(0.005)	(0.009)	(0.009)	(0.009)	(0.009)
L.p0	-0.002**	-0.002**	-0.000	-0.000	-0.002**	-0.002**	-0.000	-0.000	-0.002**	-0.002**	-0.002**	-0.002**
	(0.001)	(0.001)	(0.000)	(0.000)	(0.001)	(0.001)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)
L.lpopulasi	0.021	0.019	0.002	0.002	0.021	0.019	0.001	0.001	0.021	0.019	0.021	0.019
	(0.024)	(0.024)	(0.002)	(0.002)	(0.024)	(0.024)	(0.002)	(0.002)	(0.024)	(0.024)	(0.024)	(0.024)
L.young	0.032	0.036	-0.018	-0.010	0.031	0.035	-0.023	-0.014	0.031	0.035	0.031	0.035
	(0.069)	(0.069)	(0.030)	(0.031)	(0.069)	(0.069)	(0.032)	(0.033)	(0.069)	(0.069)	(0.069)	(0.069)
L.mountain	-0.032	-0.032	-0.015*	-0.014*	-0.032	-0.032	-0.017*	-0.017*	-0.032	-0.032	-0.032	-0.032
	(0.027)	(0.027)	(0.009)	(0.009)	(0.027)	(0.027)	(0.009)	(0.009)	(0.027)	(0.027)	(0.027)	(0.027)
_cons	-0.185	-0.220	0.021	-0.067	-0.188	-0.222	0.024	-0.071	-0.188	-0.222	-0.081	-0.121
	(0.320)	(0.323)	(0.032)	(0.060)	(0.320)	(0.323)	(0.036)	(0.064)	(0.320)	(0.323)	(0.274)	(0.279)
R-sq	0.069	0.070			0.069	0.070			0.069	0.070		
N	857	857	857	857	858	858	858	858	858	858	858	858

Note: Standard errors in parentheses.
*10% significant.
**5% significant.
***1% significant.

Table 15. Fixed Effects and Random Effects Estimations of Growth Models with Education Inequality

Initial Inequality (avg. 3 years)	Subsequent Growth (average 3 years)											
	Island				Province				*Kabupaten*			
	FE		RE		FE		RE		FE		RE	
	Linear	Nonlinear	Linear	Nonlinear	Linear	Nonlinear	Linear	Nonlinear	Linear	Nonlinear	Linear	Nonlinear
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
L.edugini	-0.081	-0.493	-0.033	0.620	-0.080	-0.522	-0.029	0.066	-0.080	-0.522	-0.080	-0.522
	(0.209)	(2.484)	(0.118)	(1.768)	(0.209)	(2.480)	(0.119)	(1.794)	(0.209)	(2.480)	(0.209)	(2.480)
L.edugini2		1.266		-1.987		1.358		-0.289		1.358		1.358
		(7.603)		(5.367)		(7.593)		(5.457)		(7.593)		(7.593)
L.pcgrdp	0.000	0.000	-0.001***	-0.001***	0.000	0.000	-0.001***	-0.001***	0.000	0.000	0.000	0.000
	(0.001)	(0.001)	(0.000)	(0.000)	(0.001)	(0.001)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)
L.unemployment	-0.179***	-0.180***	-0.133***	-0.132***	-0.179***	-0.180***	-0.165***	-0.165***	-0.179***	-0.180***	-0.179***	-0.180***
	(0.069)	(0.069)	(0.042)	(0.042)	(0.068)	(0.069)	(0.044)	(0.045)	(0.068)	(0.069)	(0.068)	(0.069)
L.asphaltroad	0.046**	0.046**	0.006	0.006	0.046**	0.046**	0.011	0.011	0.046**	0.046**	0.046**	0.046**
	(0.019)	(0.019)	(0.008)	(0.008)	(0.019)	(0.019)	(0.008)	(0.008)	(0.019)	(0.019)	(0.019)	(0.019)
L.yosf	-0.004	-0.004	-0.001	-0.001	-0.005	-0.005	-0.004	-0.004	-0.005	-0.005	-0.005	-0.005
	(0.009)	(0.009)	(0.004)	(0.004)	(0.009)	(0.009)	(0.005)	(0.005)	(0.009)	(0.009)	(0.009)	(0.009)
L.yosm	0.001	0.001	0.004	0.004	0.002	0.002	0.007	0.007	0.002	0.002	0.002	0.002
	(0.009)	(0.009)	(0.004)	(0.004)	(0.009)	(0.009)	(0.005)	(0.005)	(0.009)	(0.009)	(0.009)	(0.009)
L.p0	-0.002**	-0.002**	-0.000	-0.000	-0.002**	-0.002**	-0.000	-0.000	-0.002**	-0.002**	-0.002**	-0.002**
	(0.001)	(0.001)	(0.000)	(0.000)	(0.001)	(0.001)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)
L.lpopulasi	0.019	0.019	0.002	0.002	0.019	0.019	0.001	0.001	0.019	0.019	0.019	0.019
	(0.024)	(0.024)	(0.002)	(0.002)	(0.024)	(0.024)	(0.002)	(0.002)	(0.024)	(0.024)	(0.024)	(0.024)
L.young	0.034	0.035	-0.018	-0.018	0.033	0.034	-0.024	-0.024	0.033	0.034	0.033	0.034
	(0.069)	(0.069)	(0.030)	(0.030)	(0.069)	(0.069)	(0.033)	(0.033)	(0.069)	(0.069)	(0.069)	(0.069)
L.mountain	-0.031	-0.031	-0.015*	-0.015*	-0.031	-0.031	-0.018*	-0.018*	-0.031	-0.031	-0.031	-0.031
	(0.027)	(0.027)	(0.009)	(0.009)	(0.027)	(0.027)	(0.009)	(0.009)	(0.027)	(0.027)	(0.027)	(0.027)
_cons	-0.156	-0.120	0.030	-0.023	-0.158	-0.120	0.029	0.022	-0.158	-0.120	-0.057	-0.018
	(0.319)	(0.385)	(0.040)	(0.148)	(0.319)	(0.385)	(0.042)	(0.150)	(0.319)	(0.385)	(0.275)	(0.348)
R-sq	0.068	0.069			0.068	0.068			0.068	0.068		
N	857	857	857	857	858	858	858	858	858	858	858	858

Note: Standard errors in parentheses.
*10% significant.
**5% significant.
***1% significant.

VII. CONCLUSIONS

Increasing inequality is a growing concern is many parts of the world, including Indonesia. This paper presents an effort to search for empirical evidence of the impact of inequality on economic growth and unemployment in the Indonesian context. After the Asian financial crisis at the end of the 1990s, Indonesia has experienced a significant and continuing increase in inequality. This is in contrast with the relatively stable inequality that Indonesia experienced during the three decades of high economic growth before the crisis.

The results of analyses in this study suggest that inequality does matter for economic growth and unemployment. However, different measures of inequality associate with each outcome measure differently. Overall, the findings indicate that consumption inequality affects growth, while education inequality seems to be more important for unemployment. In general, the impact of inequality is nonlinear in the form of inverted U-shape for growth and U-shape for unemployment.

Similarly, horizontal inequality across ethnic groups is also found to have nonlinear inverted U-shape relationship with growth. Meanwhile, horizontal inequality across religion groups has nonlinear U-shape relationship with unemployment.

These findings suggest that we should treat inequality very cautiously. Initially inequality may not be harmful for growth and employment; however, after reaching a threshold, it will have an adverse impact. This implies that it is important to put in place policies to address increasing inequality and to mitigate its harmful impact.

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APPENDIX 1

Table A1. Summary Statistics of Key Variables

	Observation	Mean	Std. Dev.	Min	Max
Dependent variables					
Kabupaten GRDP growth, 2000-2012 (%)	3576	0.055647	0.052544	-0.46749	1.16728
Kabupaten unemployment rate, 2000-2012 (%)	3799	0.078588	0.043511	0.004062	0.392763
Vertical Inequality (2000-2012)					
Consumtion inequality	3799	0.292087	0.053049	0.170084	0.800361
Education Gini	3797	0.17287	0.013327	0.106866	0.21503
Horizontal Gini (2000)					
Ethnic group					
Weighted group coefficient of variation	297	0.131803	0.101474	0.016038	1.084758
Group Gini	297	0.047854	0.047713	0.000833	0.418329
Religious group					
Weighted group coefficient of variation	297	0.085694	0.062351	0.005326	0.692287
Group Gini	297	0.020505	0.026112	0.000321	0.18172
Spatial group					
Weighted group coefficient of variation	297	0.187006	0.112901	0.009558	1.049123
Group Gini	297	0.095601	0.055671	0.004777	0.491815
Horizontal Gini (2010)					
Ethnic group					
Weighted group coefficient of variation	297	0.100259	0.066431	0.003869	0.56537
Group Gini	297	0.034874	0.031265	2.89E-05	0.282706
Religious group					
Weighted group coefficient of variation	297	0.066422	0.050184	0.010538	0.461693
Group Gini	297	0.015071	0.019332	0.000334	0.209098
Fractionalization (2000)					
Religious group	297	0.154099	0.177807	0.001342	0.702915
Ethnic group	297	0.3803	0.305164	0.004008	0.880296
Fractionalization (2010)					
Religious group	297	0.149445	0.159212	0.002376	0.629252
Ethnic group	297	0.355231	0.283329	0.000144	0.881066
Heterogeneity (2000)					
Religious group (0, 1)	297	0.444444	0.497743	0	1
Ethnic group (0, 1)	297	0.693603	0.461775	0	1
Heterogeneity (2010)					
Religious group (0, 1)	297	0.444444	0.497743	0	1
Ethnic group (0, 1)	297	0.693603	0.461775	0	1

Continued

Appendix 1. *Continued*

	Observation	Mean	Std. Dev.	Min	Max
Control variables					
Poverty rate (%)	2961	16.66025	9.158474	1.41	53.22491
Log GRDP per capita (in million Rupiahs)	3795	1.684674	0.669265	0.217366	4.866916
Log of total population	3795	13.19987	0.849044	10.21691	15.51395
Mean years of schooling male (year)	3797	6.985795	1.783677	1.676342	12.07333
Mean years of schooling female (yr)	3797	5.710594	1.84655	0.720779	11.42222
Proportion of young people (%)	3799	0.314172	0.06686	0.14215	0.731574
Share of villages with asphalt main road (%)	1429	0.67893	0.259073	0	1
Share of villages in mountainous areas	1429	0.190138	0.17783	0	1

The SMERU Research Institute

Telephone : +62 21 3193 6336
Fax : +62 21 3193 0850
E-mail : smeru@smeru.or.id
Website : www. smeru. or.id
Facebook : The SMERU Research Institute
Twitter : @SMERUInstitute
YouTube : SMERU Research Institute

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