Is it Fair to be Unfair?

BACHELOR THESIS

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1 | Introduction

OESO published an article at the end of 2014, wherein the relationship between income inequality and economic growth is discussed. From their research, they concluded that a high inequality in disposable income is accompanied by a lower economic growth [Causa et al., 2014]. There are more economists who claim that income inequality has a negative effect on economic growth. Piketty showed in his book, *Capital in the Twenty-first Century*, that wealth is concentrated in the hands of the rich people, raising income inequality. In most societies, equality is an important value, since income inequality may cause a lack of income mobility and opportunity. A bigger gap between the rich and the poor can cause significant implications for economic growth [Dabla-Norris et al., 2015].

A big challenge in the economic world is to fight against poverty. To fight poverty, it should be noted that there is a strong connection between poverty and income inequality. Income should exceed a certain threshold to reduce poverty. According to some economists, economic growth is a powerful force for reducing income inequality and to reduce poverty as well [Ravallion, 2001]. To show the relationship between economic growth, income inequality and poverty, the economist Bourguignon developed The Triangle of Growth, Inequality and Poverty. In his article Bourguignon concluded that poverty reduction is determined entirely by the rate of economic growth and the average income of the population, of a given country at a given time, and the change in income distribution [Bourguignon, 2004].

The relationship between economic growth and income inequality has been very important, while researching economic development. However, there are contradictions in economic thinking as some economists claim that income inequality stimulates economic growth, while others claim that the unequal distribution of income hampers economic growth and increases poverty. In this paper, special attention will be payed to the question *'What is the effect of economic growth on income inequality?'*

There have been several studies on this effect. For example, from 1984 until 1992, China had a remarkable period of economic growth, but also the income distribution became more unequal. However, this effect is not always observed. From 1977 until 1991, The United Kingdom suffered a period of negative economic growth, but at the same time, the income distribution also became more unequal [Li and Zou, 1998]. As we can see, there is no simple answer to the question what the effect is of economic growth on the income inequality.

2 | Theoretical Framework

Before examining the effect of economic growth on income inequality, the two concepts will be discussed separately. Also, it will be explained how to measure these two concepts and what the relationship is between economic growth and income inequality.

2.1 | Economic Growth

Economic growth is measured by looking at the difference in Gross Domestic Product(GDP) in a certain period of time. GDP equals the sum of what is being produced, consumed, or the sum of the disposable income. The economist, Eric Jones, made a distinction between intensive and extensive economic growth. Extensive growth means that the GDP growth is caused by an increase in population, which means that the disposable income of households did not grow. However, intensive growth means that the welfare per capita has grown, which is accompanied with a larger disposable income [Jones, 1988]. In this thesis, there is only spoken of economic growth if the purchasing power of the population increased, while disposable income becomes larger. For this reason, GDP is often adjusted for inflation, which results in real economic growth [Kravis et al., 1978].

GDP growth measures the output of an actual economy and GDP can be defined as a measure of the total production in a country. For this reason, in this research GDP equals the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products, which equals the sum of what is being produced.

2.2 | Income Inequality

Income inequality can be described as the unequal distribution of income among individual participants in the economy, households within a country, or worldwide. When people think about income inequality, they are used to think within the borders of their own country, but as the world gets more integrated, the global dimension of income inequality becomes more relevant. For this reason a distinction needs to be made between income inequality within the borders of a country and income inequality worldwide [Milanovic, 2013].

In a new report, *Causes and Consequences of Income Inequality: A Global Perspective*, the IMF claims that the income inequality, within the borders of the countries, has increased between 1990 and 2014, even though some of the countries where characterized by economic growth. In today's society, a significant majority of households in developing countries are living in a society, where income is more unequally distributed than it was in the nineties [Dabla-Norris et al., 2015]. Evidence also shows that in the last few decades some measures of global inequality exhibit a declining trend as a response of higher incomes for those who live in countries with a big population, like China and India [Milanovic, 2013]. Usually, when the GDP is boosted, the boost is accompanied by a higher income inequality. However, some countries have managed to contain or reduce income inequality, while achieving strong economic growth [Hoeller et al., 2014].

There are different factors, which influence income inequality. One of the main drivers in the last decades has been globalization. Empirical evidence shows that there is a strong correlation between the index of globalization and average level of

income inequality [UNDP, 2013]. Globalization has improved trade among several countries, which has been an engine for economic growth. Nonetheless, in this wave of globalization the inequality is increasing, because the high demand, which is an effect of globalization, leads to higher wages for high skilled workers, but this also means that low skilled workers get lower wages [Kremer and Maskin, 2006]. However, policy measurements can be taken to distribute income more equally. For example, subsidies can be given or a minimum wage can be introduced to improve the wealth distribution [Dabla-Norris et al., 2015].

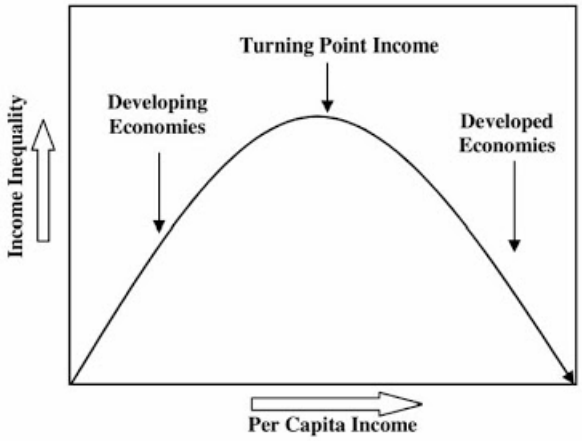
The most common index to measure income inequality is the Gini coefficient. This number ranges between 0 and 1. When the coefficient is 0, this indicates a perfect equality in income while a Gini coefficient of 1 expresses maximal inequality [Yitzhaki, 1979]. However, a number of alternative methods to calculate the income inequality exist. For example, the 20:20 Ratio and the Palma Ratio. These methods use the percentile ratios of the poorest en the richest groups of the total population to illustrate deviance from the perfect income equality [Cobham, 2013]. Unfortunately, these ratios only measure the shape of the income distribution by using the outliers and they do not represent the overall level of income inequality. Another method to measure income inequality is to calculate the proportion of income, which would have to be redistributed to achieve a state of perfect income equality, this is called the Hoover index. The last alternative used to calculate income inequality is the Theil index. This index varies between 0 and 1. The Theil index measures the entropic distance the population is removed from having equally distributed income. A higher index indicates that the population is further away from perfect equality in income [Coulter, 1989].

The Gini coefficient includes all data and is the most commonly used measure for income inequality in economic work. For this reason the Gini coefficient will be used in this research as well. See appendix A.1 for calculations of the Gini coefficient.

2.3 | Economic Growth and Income Inequality

In this section, the relationship between economic growth and income inequality will be discussed. The first hypothesis about economic growth and income inequality has been introduced by the economist Simon Kuznets. Kuznets has introduced a curve, which attempts to illustrate what happens with the income inequality when the economy gets industrialized. The Kuznets curve graphs economic inequality against income per capita over the course of economic development [Kuznets, 1955].

Figure 2.1: Kuznets Curve



Kuznets assumed that income is more equally distributed in a rural agricultural economy, where incomes are lower, than in an urban industrial economy, where income inequality is raised, because of the fact that a higher fraction of workers earn higher

wages. However, this causes an economy to shift from rural areas to the cities, because farmers begin to migrate, trying to find better-paying jobs, causing a decrease in rural populations and a increase in urban populations. This migration results in a large rural-urban income gap. Nonetheless, after a certain point, industrialization will improve income distribution, since more and more workers find jobs in the cities, because of the changes in the economy. This results in a situation, wherein most workers earn more similar industrial wages. This story results in an inverted U-shaped relationship between income levels and inequality, like is showed in figure 2.1 [Gallup, 2012].

The relationship between economic growth and income inequality has always been of interest to the economists. After the work of Kuznets a conclusion was made that there is an inverse relationship between equality and growth and that countries are facing a trade-off between reducing income inequality and promoting growth. However, in the last few decades, this view has been re-examined.

The measured effect of income inequality on the economic growth is sensitive to the way data sets are used. Some economists even claim that a trade-off has to be made between economic growth and income inequality. Some inequality is needed to propel growth. Inequality provides incentives for investment and work as people are prepared to work harder if they receive a monetary reward. These monetary rewards are optimal for economic growth, but affects income inequality negatively, which causes tension between economic growth and income inequality [Okun, 1975].

2.3.1 | Effect of Income Inequality on Economic Growth

In the early stages of the debate, about the effect of income inequality on economic growth, a dominant position was taken by those who claimed that there is a negative relationship between income inequality and economic growth. One of the first economists who suggested that inequality hampers growth was Perotti. In his research, Perotti developed a theoretical model, wherein different growth rates were generated by different income distributions and different levels of income. In Perotti's model the negative relationship of income inequality on economic growth can be explained by the fact that poor households are not able to invest in human capital, which is necessary for promoting economic growth [Perotti, 1993]. However, other economists claim that economic growth stimulates employment, which reduces income inequality between households. This allows the government to allocate more tax in different estates, which encourages the poor to invest more in human capital [Norton, 2002a].

To explore the complex relationship between economic growth and income inequality many researches have been done. What is curious, is that theoretical arguments, in late literature, for the effect of income inequality on economic growth tend to conclude that 'incentives' play a big part in explaining the relationship. The economist Kaldor claimed that income inequality generates incentives to channel resources into more efficient uses in entrepreneurial activities. This leads to an improvement in saving and capital-accumulation, which are required for promoting growth [Alesina and Perotti, 1996]. This argument is extended by the finding that inequality encourages incentives to invest more in human capital, which results in more employment and thus promotes economic growth [Cingano, 2014].

In more recent studies, three main arguments can be found about the relationship of equality and growth. The first argument is called the wealth effect argument, which starts with a premise that there is a relationship between current and future wealth. This argument claims that a more equal economy grows faster than a less equal one. Inequality in wealth is caused due to the fact that wealthy people can afford an optimal level of investment. This will be harder for poorer people. This eventually results in a conclusion that both income inequality and economic growth must go down over time on average, which results in a conclusion that there is no income inequality and no economic growth in the long run [Banerjee and Duflo, 2003].

The second argument, the so-called political economy argument, claims that when income inequality is high, poor people will choose for high levels of redistribution, even though this will hurt economic growth [Alesina and Rodrik, 1996]. Government policies will tend to support redistribution of income. Such policies have a tendency to distort economic growth, because they cost a lot of money. This will lead in a reduction in investments in the long run, which hampers economic growth [Barro, 2000]. On the other side, there is an idea that the lack of growth opportunities causes conflicts in society, because people will start to feel frustrated. These conflicts can lead to changes in inequality and influence growth in a positive way [Banerjee and Duflo, 2003].

The last argument is about the imperfections in the credit market. These imperfections are argued to cause a reduction in investments, as they imply limited access to credit, especially in the case of the poor people who have less to spend and have to prove that they are creditworthy. The more people are limited to credit, the less

investments can be made, which will hurt economic growth. In a more equal economy less people would find themselves in this situation, which will promote economic growth due the fact that more investments can be made [Acemoglu, 2001].

The literature draws the idea that the effect of income inequality on economic growth depends on the level of development within each country: political economy arguments indicate that the poor people have the power to hamper economic growth and it is up to the government in which way they intervene in the relationship by re-allocating endownments, which play a critical role in the wealth effect argument. This leads to a conclusion that theoretical work can give limited insight in the effect of income inequality on economic growth, because of the conflicts described above. This idea is strengthened by the existence of a debate, wherein three different positions are taken; some economists claim that there is a positive relationship, some claim a negative relationship, while others claim the existence of a non-linear relationship.

The impact of inequality on economic growth is widely discussed in literature, but the inverse relationship has found less favour in economic examination.

2.3.2 | Effect of Economic Growth on Income Inequality

Most of the research about the relationship between income inequality and economic growth has either looked at the impact that inequality might have on growth or at the impact of various socio-economic variables on inequality. Little research has been done on the effect that economic growth might have on income inequality. There is some empirical literature about this relationship, but the quality of the underlying data has hampered the empirical analysis of the relationship between economic

growth and income inequality. This is because of the fact that cross-country data was limited. Deiniger and Squire, were the first ones who have constructed time series by taking estimates of Gini coefficients from hundreds of separated studies of inequality in individual countries. Using this new data set, the authors concluded that countries which undergo rapid economic growth do not necessarily follow Kuznets' hypothesized pattern. Concluding that a systematic link between economic growth and changes in aggregate income inequality were not found [Deininger and Squire, 1996].

The economist, Forbes, has argued that empirical literature that finds a negative relationship between economic growth and income inequality in the short run are not robust as they did not account for a omitted variable bias. To take the omitted variable bias into account, a panel data model can be used to control for time-invariant country-specific effects. Using this method, Forbes found a positive relationship between economic growth and income inequality in the short run while he found a negative relationship in the long run [Forbes, 2000].

In theory, economic growth is considered to be a powerful tool for reducing income inequality by reducing poverty. This can be explained by the fact that if economic growth occurs, the labor demand will rise, which reduces unemployment and the wage differentials between households [Norton, 2002b]. Furthermore, if economic growth leads to more labor income, the higher level of income leads to more tax income, which allows the state to allocate more money in different estates such as education and health. This will favor the poor to invest more in human capital which will reduce income inequality even more [Barro, 2001].

However, recently an analysis has been performed on the relationship between economic growth and income inequality in the US from 1953 until 2008. In this research, it is claimed that rich people are more sensitive for economic growth than poor people. The evidence comes in twofold: the high income groups receive a high proportion of their income from wealth, while the low income groups receive a higher proportion of their income from labor, which is less sensitive to growth than income, which is provided by wealth. The second reason consists of the fact that the high income group receives a large proportion of their labor income in the form of pay-for-performance, which is also sensitive to growth, contrary to the labor income of the poorer people, which mostly consists of a fixed wage. These findings result in a conclusion that economic growth has an positive effect on income inequality, which means that when the economy grows, income inequality rises as well [Rubin and Segal, 2015].

Despite the fact that the effect of economic growth on income inequality has found less favor in the literature than the reverse effect, a conclusion can be made that the literature is divided by whether economic growth has a positive or negative effect on income inequality. This research will pay attention to the question what the effect is of economic growth on income inequality by using more recent data and by taking the country- and time-specific effects into account by using panel data.

3 | Data

In this section, the data and method used to analyze the effect of economic growth on income inequality is discussed.

The analysis has been done by using two different kinds of data sets from the year 1983 until 2004. The first data set consists of eighteen developed countries, while the second set consists of twelve developing countries. Data to distinguish developed and developing countries is gathered from the World Bank. Developing countries are defined as those with a Gross National Income per capita of $1025 or less in 2015, while developed countries are those with a Gross National Income per capita of $12.476 or more[World Bank, 2016].

To analyze the effect of economic growth on income inequality different control variables are used. These are variables that are related to the dependent variable, in this case the GINI coefficient or the income inequality. Control variables are added to the equation to isolate the effect they have on the dependent variable. Underneath a list of the used control variables is given:

Life expectancy: A higher life expectancy indicates that people stay healthy for a longer time, which also means that the population within a country is able to work longer than in a country where life expectancy is lower [Wilkinson, 1992]. It is expected that life expectancy will have a negative effect on income inequality, since a higher life expectancy within a country indirectly indicates that the population is able to work longer, which will eventually minimize the income inequality.

Unemployment rate: A high unemployment rate tends to increase the income inequality, as there exists a difference in incomes of employed and unemployed people.

Gross capital formation: This term refers to additions in capital stock. Capital stocks are needed to replace current assets, which are used in production within a country. When a country is not able to replace its capital goods, production will decline eventually [OECD, 2001]. Generally, producing more goods and services can lead to an increase in national income levels, which gives the government the opportunity to invest in society and thus to reduce income inequality.

Minimum Wage: A minimum wage, which is set by the government, is the lowest salary that employers may legally pay to their employees in exchange for labor [Brown et al., 1982]. A minimum wage is mostly set to redistribute the income within a country with the goal to reduce income inequality. In the data set countries that have a minimum wage, which is set by the government, have a dummy variable of 1. Those countries that do not have a minimum wage that is legally obliged have a dummy variable of 0.

Unemployment benefits: These are social welfare payments made by the state to people who got unemployed involuntarily. Countries that have an unemployment insurance tend to suffer from a larger increase in unemployment, which affects income inequality negatively [Katz and Meyer, 1990]. On the other hand, economists argue that unemployment benefits reduce income inequality, because unemployed people are getting an income. In the data set, the countries in which an unemployment insurance is used, have a dummy variable of 1 and 0 otherwise.

Educational attainment: To gather data about educational attainment the Barro-Lee Educational Attainment Data is used. The used data set exhibits the average years of total schooling, from the age of 15 years, among countries from the year 1983 until 2004. Because the data is constructed by five year intervals, the intermediate years are interpolated linearly. Usually, people who have attained higher education, earn higher wages, which means that the educational attainment of an country affects income inequality [Breen and Jonsson, 2005].

The summary statistics of all the variables are displayed in these tables:

Table 3.1: Summary statistics of the 18 developed countries

	Developed			
	Mean	StdDev	Min	Max
Educational Attainment	9.30	1.59	5.11	12.82
Gross Capital Formation	22.54	3.56	9.85	32.89
Unemployment Rate	8.37	3.92	1.56	24.12
Life Expectancy	76.42	1.99	69.41	80.78
GDP	19061.79	10373.89	1361.52	57570.27
GINI	30.43	6.86	20.75	51.40

Table 3.2: Summary statistics 12 undeveloped countries

	Undeveloped			
	Mean	Standard Deviation	Min	Max
Educational Attainment	6.67	1.61	2.37	9.59
Gross Capital Formation	23.50	7.43	9.30	45.78
Unemployment Rate	9.59	6.30	1.80	30.41
Life Expectancy	67.91	4.85	51.87	75.80
GDP	2313.05	1498.05	223.73	7115.12
GINI	44.79	6.49	24.75	55.79

4 | Methodology

In this thesis, the relation of economic growth on income inequality will be analyzed. To research whether economic growth will enhance the income inequality, a panel data model is used. Panel data is data where different individuals are observed over time. This means that for multiple countries the economic growth is observed repeatedly over time. In this case, the time period from 1983 until 2004 is used. Panel data can help to get rid of omitted variable bias by analyzing changes in the dependent and independent variables and leads to increased precision in parameter estimation, because of the larger number of observations.

This analysis will be done in several steps. First of all, some assumptions of Ordinary Least Squares estimation will be discussed. Ordinary Least Squares estimation is a method to estimate the unknown parameters in a linear regression. More explicitly, it attempts to find the best fit between the dependent and the independent variable. To do this properly, a few assumptions need to hold:

- Assumption 1: No Heteroskedasticity:

  This means that the variance of the error term needs to be constant for all observations, which implies that the error term is not correlated with the independent variable.

- Assumption 2: No Serial Correlation:

  The error terms must have a covariance of zero, which will indicate that the error terms are independently distributed. To test for auto correlation the Durbin-Watson test will be used.

- Assumption 3: Normally Distributed Errors:

  The error terms need to be normally distributed. This can be tested by using the Jarque-Bera test.

In the next step the panel data model will be introduced:

$$\begin{aligned} GINI_{i,t} = \alpha_{i,t} + \beta_{1i,t} * GDP_{i,t} + \beta_{2i,t} * LIFEEXP_{i,t} + \beta_{3i,t} * GCF_{i,t} \\ + \beta_{4i,t} * UNEMP_{i,t} + \beta_{5i,t} * MINWAGE \\ + \beta_{6i,t} * UNEMPBEN + \beta_{7i,t} * EDUCAT + \epsilon_{i,t} \end{aligned} \quad (4.1)$$

The GINI variable indicates the income inequality and will, first of all, be dependent on the GDP. GDP reflects the economic growth per capita. Secondly, the GINI depends on life expectancy at birth, the unemployment rate as a percentage of the total labor force, Gross Capital Formation, the minimum wage which is set by the government, the unemployment benefits and the educational attainment.

This is the most general panel data model, where each individual has its own coefficients, which are specific to each time period. Obviously, this model is too general, which causes that the parameters cannot be estimated. To solve this problem, restrictions need to be imposed. For this reason the individual and time -specific effects model will be introduced. In this model $\alpha_{i,t} = \alpha_i$ for all time periods and $\beta_{i,t} = \beta$ for all individual countries over the specific time period. However, to absorb time specific effects, such as a trend or other inexplicable events, like a recession, a λ_t will also be introduced to incorporate these effects in the model. This will result in:

$$GINI_{i,t} = \alpha_i + \lambda_t + \beta_1 * GDP_{i,t} + \beta_2 * LIFEEXP_{i,t} + \beta_3 * GCF_{i,t} + \beta_4 * UNEMP_{i,t} + \beta_5 * MINWAGE + \beta_6 * UNEMPBEN + \beta_7 * EDUCAT + \epsilon_{i,t} \quad (4.2)$$

The intercept α_i may be interpreted as a random variable, which means that the variable is not dependent on explanatory factors. A distinction can be made between the Fixed Effects Model and the Random Effects Model. In the first model α_i is potentially correlated with other independent variables where in the second case, α_i is uncorrelated with the other independent variables. This can be tested with the Hausman test. When the Hausman test implies a Random Effects Model this indicates that a pooled model needs to be used with a different covariance structure of the error terms and that the α is equal for all countries and also does not depend on time periods, which results in:

$$GINI_{i,t} = \alpha + \lambda_t + \beta_1 * GDP_{i,t} + \beta_2 * LIFEEXP_{i,t} + \beta_3 * GCF_{i,t} + \beta_4 * UNEMP_{i,t} + \beta_5 * MINWAGE + \beta_6 * UNEMPBEN + \beta_7 * EDUCAT + \delta_{i,t} \quad (4.3)$$

This indicates that α is equal for all countries, but that there are several outliers which cannot be explained and need to be absorbed by the error term. This results in:

$$\delta_{i,t} = (\alpha_i - \alpha) + \epsilon_{i,t} \quad (4.4)$$

Simply put, the random effects in α are absorbed by the error term when there is a Random Effects Model. However, when the Hausman test implies a Fixed Effects

Model a Fixed Effects estimator can be used to estimate α_i, which indicates that the coefficient is unique for each country. The coefficient estimates of the $\beta's$ depend on which estimator is used, the Random Effects Estimator or the Fixed Effects Estimator.

In the next step an analysis will be done making a distinction between developed and developing countries:

$$GINI_{i,t} = \alpha_i + \lambda_t + \beta_1 * GDP_{i,t} + \beta_2 * LIFEEXP_{i,t} + \beta_3 * GCF_{i,t} + \beta_4 * UNEMP_{i,t} + \beta_5 * MINWAGE + \beta_6 * UNEMPBEN + \beta_7 * EDUCAT + \epsilon_{i,t} \quad (4.5)$$

Simply put, this analysis will be done twice, once for developed countries and once for developing countries, with the goal to compare the outcomes of those two.

5 | Results

5.1 | Pooled Model

The Pooled Model is the most general panel data model:

$$\begin{aligned} GINI_{i,t} = \alpha_{i,t} + \beta_{1i,t} * GDP_{i,t} + \beta_{2i,t} * LIFEEXP_{i,t} + \beta_{3i,t} * GCF_{i,t} \\ + \beta_{4i,t} * UNEMP_{i,t} + \beta_{5i,t} * MINWAGE \\ + \beta_{6i,t} * UNEMPBEN + \beta_{7i,t} * EDUCAT + \epsilon_{i,t} \end{aligned} \quad (5.1)$$

In this model all observations are ran, neglecting the cross section and time series nature of data. The major problem with this model is that is does not distinguish between the various countries in the data set. In other words, by combining 30 countries by pooling, the heterogeneity or individuality that may exist among the 30 countries, is being denied. The results of the pooled model can be found in the appendix A.3.

5.2 | Fixed Effects Model

The Fixed Effects Model allows for heterogeneity or individuality among the different countries, by allowing the countries to have its own intercept value. The term, 'Fixed Effects', is due to the fact that, although the intercept may differ across the different countries, the intercept does not vary over time, ergo the intercept is time invariant. To absorb time specific effects a λ_t is also introduced in the model to incorporate these effects. This results in:

$$GINI_{i,t} = \alpha_i + \lambda_t + \beta_1 * GDP_{i,t} + \beta_2 * LIFEEXP_{i,t} + \beta_3 * GCF_{i,t} + \beta_4 * UNEMP_{i,t} + \beta_5 * MINWAGE + \beta_6 * UNEMPBEN + \beta_7 * EDUCAT + \epsilon_{i,t} \quad (5.2)$$

The results of the Fixed Effect Model can be found in figure 5.1 until figure 5.3.

Figure 5.1: Results of All Countries Fixed Effect Model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	42.22926	12.39355	3.407359	0.0015
D(LOG(GDP))	-1.711949	3.052725	-0.560794	0.5781
LIFE_EXP	-0.090705	0.210735	-0.430423	0.6692
GCF	0.052736	0.084613	0.623262	0.5367
UNEMPLOYMENT	0.214557	0.146840	1.461164	0.1518
MINIMUM_WAGE	-0.285534	2.091886	-0.136496	0.8921
UNEMPLOYMENT_BENEFIT	4.434494	2.219250	1.998195	0.0525
EDUCATIONAL_ATTAINMENT	0.800657	0.568658	1.407977	0.1669

From the Fixed Effect Model a conclusion can be made that none of the variables influence income inequality at a significance level of 0.05.

Figure 5.2: Results of Developed Countries Fixed Effect Model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	22.61428	15.36423	1.471879	0.1420
D(LOG(GDP))	-3.676043	1.262992	-2.910582	0.0039
LIFE_EXP	0.127021	0.207465	0.612252	0.5408
GCF	0.021099	0.051341	0.410954	0.6814
UNEMPLOYMENT	0.068214	0.053500	1.275026	0.2032
MINIMUM_WAGE	-0.610540	0.512380	-1.191576	0.2343
UNEMPLOYMENT_BENEFIT	0.107274	0.706037	0.151938	0.8793
EDUCATIONAL_ATTAINMENT	-0.260284	0.293705	-0.886207	0.3761

Economic growth seems to be the only variable which influences income inequality negatively at a significance level of 0.05.

Figure 5.3: Results of Developing Countries Fixed Effect Model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	75.87193	7.682509	9.875931	0.0000
D(LOG(GDP))	0.002330	1.137302	0.002049	0.9984
LIFE_EXP	-0.406841	0.092359	-4.404999	0.0000
GCF	0.051756	0.039523	1.309521	0.1918
UNEMPLOYMENT	0.168857	0.067035	2.518939	0.0125
MINIMUM_WAGE	2.440169	0.683020	3.572616	0.0004
UNEMPLOYMENT_BENEFIT	-0.072435	0.779556	-0.092918	0.9261
EDUCATIONAL_ATTAINMENT	-1.108098	0.549327	-2.017190	0.0449

The income inequality in developing countries seems to be influenced by life expectancy, the unemployment rate, a minimum wage and educational attainment at a significance level of 0.05.

The results show that none of the variables influence income inequality if both developed and developing countries are taken together. On the other hand, if developed and developing countries are separated in the model, then economic growth is the only variable that influences income inequality in developed countries, while this variable does not influence income inequality in developing countries.

When looking at figure 5.2, where the effect of economic growth on income inequality is displayed for developed countries, the estimated coefficient of economic growth has a value of -3.676. This means that if the variable GDP grows with 1%, the value of D(LOG(GDP)) equals 1 and hence income inequality will decline with 3.676. Concluding that economic growth has a negative effect on income inequality; when the economy grows the income distribution becomes less equal.

5.3 | Random Effect Model

The Random Effect Model is represented by:

$$GINI_{i,t} = \alpha + \lambda_t + \beta_1 * GDP_{i,t} + \beta_2 * LIFEEXP_{i,t} + \beta_3 * GCF_{i,t} + \beta_4 * UNEMP_{i,t} + \beta_5 * MINWAGE + \beta_6 * UNEMPBEN + \beta_7 * EDUCAT + \delta_{i,t} \quad (5.3)$$

Simply put, this model indicates that the examined countries have a common mean value of the intercept. The results can be found in Appendix A.4.

Furthermore, the Random Effect Model shows that economic growth has an effect on income inequality in developed countries, while it has no effect on income inequality in developing countries or when the countries are clustered together.

5.4 | Hausman Test

After estimating the above three models, a decision should be made which model is suitable to accept. Therefore, the Hausman Test should be used.

The Hausman Test exists of two hypothesis:
1. Null Hypothesis: Random Effects Model is appropriate
2. Alternative Hypothesis: Fixed Effects Model is appropriate

If there is a statistically significant p-value then the Fixed Effect Model should be used, but if the p-value is statistically insignificant, then the Random Effect Model should be chosen.

So in other words; if the p-value < 0.05, then the null hypothesis is rejected and the alternative hypothesis is accepted, which means that the Fixed Effect Model should be used. If the P-value > 0.05, then the null hypothesis is accepted, which results in a Random Effects Model. The figures 5.4 until 5.6 show the results of the Hausman Test:

Figure 5.4: Results of All Countries Hausman Test

Correlated Random Effects - Hausman Test
Equation: POOLED
Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	49.683255	7	0.0000

P-value < 0.05, this means that the Null Hypothesis should be rejected and that the Fixed Effects model should be used.

Figure 5.5: Results of Developed Countries Hausman Test

Correlated Random Effects - Hausman Test
Equation: Untitled
Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	31.005028	7	0.0001

P-value < 0.05, This means that the Fixed Effects Model is appropriate.

Figure 5.6: Results of Developing Countries Hausman Test

Correlated Random Effects - Hausman Test
Equation: Untitled
Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	16.759745	7	0.0190

P-value < 0.05, this indicates a rejection of the Null Hypothesis which means that the Fixed Effects model should be used.

From the figures 5.4 until 5.6 the conclusion can be made that the Fixed Effects Model is the most appropriate model.

6 | Conclusion

In this paper, the effect of economic growth on income inequality has been researched. The relationship between economic growth and income inequality is examined by researching literature and examining the results of a panel data model. In this paper, attention is paid to the question whether there is a difference between the effect of economic growth on income inequality in developed and developing countries. This is examined with a panel data model.

The Kuznets' curve has spawned a vast amount of economic literature about the effect of income inequality on economic growth. Within recent literature three main arguments can be found: wealth effect argument, political economy argument and the argument about credit market imperfections. The outcome of these arguments depends on the level of development within each country, which leads to the idea that limited insight into the relationship between economic growth and income inequality can be given. This idea is even strengthened by the fact that empirical research is also divided between three different positions, as some economists find a positive, a negative, or a non linear relationship between the two variables. It should be clear that these arguments point to a causal relationship from inequality to growth, while the main question of this paper considers the effect in the opposite direction. This leads to the fact that no conclusion can be made about the causal direction of the relationship of income inequality on economic growth.

Most of the research on the relationship of income inequality and economic growth has focused on the effects that income inequality might have on economic growth, but there still exists some economic literature on the opposite effect. Some economists claim the existence of a positive relationship between economic growth and income inequality; Forbes aims to prove a positive relationship in the short run by using a panel data model. A recent paper about the relationship of economic growth on income inequality supports Forbes' findings with a theory that rich people are more sensitive to economic growth than poor people. However, some theories emphasizes a negative relationship by claiming that economic growth is a powerful tool to reduce income inequality, because economic growth rearranges the labor market and gives the government the opportunity to invest in different estates, which will favor the poor to invest in human capital.

After reviewing the economic literature about the relationship between economic growth and income inequality, an attempt is made to analyze the effect of economic growth on income inequality for both developed and developing countries. To achieve this, a panel data model is used to take the country- and time-specific effects into account. This will increase the efficiency of the coefficient accuracy compared to more recent studies, which have used either cross-section or time-series. Furthermore, it should be noted that no literature has examined if there is a difference in the results for developed and developing countries.

Different variables are introduced in the panel data model, where economic growth is the main variable. Three different models have been built: Pooled Model, Fixed Effects Model and Random Effects Model. The Hausman Test has been used to draw the conclusion that the Fixed Effects Model is the most appropriate one.

The Fixed Effects Model shows that there does not seem to be a relationship between economic growth and income inequality if developed and developing countries are clustered together. However, if developed and developing countries are separated, economic growth has an negative effect on income inequality in developed countries, with the value of -3.676, but no effect in developing countries. Table 3.1 shows that the minimum value of the GINI is 20.75, while the maximum value is 51.40. This means that an effect of economic growth on income inequality of -3.676 is quite large, since this indicates that when the GINI is at the maximum value of 51.40, a decrease of 3.676 in absolute numbers is a decrease of 7.16% relatively. When the GINI is at the minimum value of 20.75, a decrease of 3.676 is a decrease of 17.83% relatively.

The measured effect of economic growth on income inequality depends on the way data sets are used. For this reason it is important to not only look at the relationship between economic growth and income inequality, but to also look at the factors which can distinguish the fact that the results differ. This can be done by looking at the differences between developed and developing countries. Further economic research could focus on the question why the results in economic literature differ, for example, by examining the relationship between economic growth and income inequality within urban and rural areas. Furthermore, this paper only examines the linear relationship between economic growth and income inequality, however, according to Kuznets there is a non-linear relationship. It would add value to economic literature to investigate the presence of a non-linear relationship, as well as a turning point in the development of income inequality, where developing economies become developed economies. All things considered, it seems as if the most important questions in economics, are the hardest to answer.

A | Appendix

A.1 | Calculation Gini Coefficient

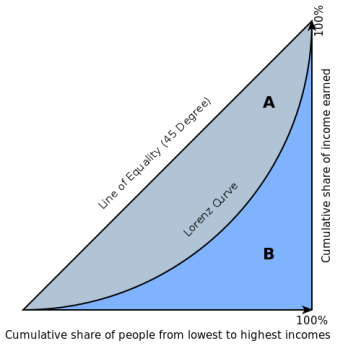
The Gini coefficient was developed to measure income inequality in society. In figure A.1 the Lorenz curve is represented. The horizontal axis represents the percentage of the people while the vertical axis represents the percentage of income those people receive.

The Gini coefficient is defined as a ratio of the areas A and B of the Lorenz curve:

$$Gini = \frac{A}{A+B} \tag{A.1}$$

Income Inequality is implied when the Lorenz curve is below the 45 degree line, which represents perfect equality. If area A equals 0, this means that there is a perfect distribution of income and everybody earns the same amount. If area A gets bigger this will be accompanied with a larger Gini coefficient which indicates that the distribution of income is uneven [Yitzhaki, 1979].

Figure A.1: Lorenz Curve



A.2 | Data

A.2.1 | Developed Countries and Developing Countries

This data set consists of a collection of eighteen countries from the year 1983 until 2004:

Table A.1: Developed Countries

Australia	Austria	Belgium	Chile
Denmark	Finland	France	Greece
Ireland	Italy	Netherlands	Norway
Portugal	Spain	Sweden	United Kingdom
United States	Uruguay		

For the same time period data is collected for twelve developing countries:

Table A.2: Developing Countries

Brazil	China	Colombia	Jamaica
Malaysia	Mexico	Pakistan	Panama
Peru	Philippines	South Africa	Turkey

A.3 | Pooled Model

A.3.1 | All Countries

Figure A.2: Results of All Countries Pooled Model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	70.69791	4.914998	14.38412	0.0000
D(LOG(GDP))	-0.389390	2.163793	-0.179957	0.8572
EDUCATIONAL_ATTAINMENT	0.202502	0.184237	1.099136	0.2721
GCF	-0.090351	0.053081	-1.702136	0.0892
LIFE_EXP	-0.464204	0.082882	-5.600820	0.0000
MINIMUM_WAGE	3.914231	0.525057	7.454862	0.0000
UNEMPLOYMENT	0.453600	0.055040	8.241357	0.0000
UNEMPLOYMENT_BENEFIT	-10.19107	0.744970	-13.67985	0.0000

The pooled model for all countries shows that economic growth has no effect on income inequality. But also educational attainment and gross capital formation seem to have no effect on income inequality at a significance level of 0.05.

A.3.2 | Developed Countries

Figure A.3: Results of Developed Countries Pooled Model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	67.56878	11.56597	5.842033	0.0000
D(LOG(GDP))	-1.718851	2.507047	-0.685608	0.4934
EDUCATIONAL_ATTAINMENT	-0.167105	0.205790	-0.812015	0.4173
GCF	-0.335764	0.087571	-3.834179	0.0001
LIFE_EXP	-0.218437	0.171165	-1.276181	0.2027
MINIMUM_WAGE	4.624181	0.562950	8.214198	0.0000
UNEMPLOYMENT	0.214306	0.080090	2.675803	0.0078
UNEMPLOYMENT_BENEFIT	-16.30639	1.249766	-13.04756	0.0000

In developed countries, economic growth also does not have any effect on income inequality. Besides economic growth, also educational attainment and life expectancy don't influence economic income inequality at a significance level op 0.05.

A.3.3 | Developing Countries

Figure A.4: Results of Developing Countries Pooled Model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	32.64121	5.527691	5.905035	0.0000
D(LOG(GDP))	1.268774	2.278487	0.556849	0.5781
EDUCATIONAL_ATTAINMENT	1.468187	0.288985	5.080492	0.0000
GCF	-0.204808	0.050375	-4.065689	0.0001
LIFE_EXP	0.031820	0.101887	0.312307	0.7551
MINIMUM_WAGE	1.494232	0.730035	2.046794	0.0417
UNEMPLOYMENT	0.377667	0.064910	5.818292	0.0000
UNEMPLOYMENT_BENEFIT	6.236668	0.989797	6.300959	0.0000

In developing countries economic growth does not have any effect on the income inequality. Other variables, such as educational attainment, gross capital formation, the unemployment rate and unemployment benefits seem to have an effect at a significance level of 0.05.

A.4 | Random Effect Model

A.4.1 | All Countries

Figure A.5: Results of All Countries Random Effect Model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	35.41062	4.248504	8.334844	0.0000
D(LOG(GDP))	-0.940603	0.658746	-1.427869	0.1538
EDUCATIONAL_ATTAINMENT	0.941390	0.159467	5.903360	0.0000
GCF	0.055388	0.026766	2.069362	0.0389
LIFE_EXP	-0.142141	0.065502	-2.170014	0.0304
MINIMUM_WAGE	1.323172	0.405692	3.261518	0.0012
UNEMPLOYMENT	0.177153	0.036501	4.853375	0.0000
UNEMPLOYMENT_BENEFIT	-0.073254	0.495093	-0.147959	0.8824

at a significance level of 0.05 economic growth and unemployment benefits do not influence income inequality.

A.4.2 | Developed Countries

Figure A.6: Results of Developed Countries Random Effect Model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-16.70828	7.150600	-2.336627	0.0200
D(LOG(GDP))	-2.090110	0.771666	-2.708569	0.0071
EDUCATIONAL_ATTAINMENT	0.112767	0.256045	0.440420	0.6599
GCF	0.002840	0.047022	0.060398	0.9519
LIFE_EXP	0.603368	0.116414	5.182953	0.0000
MINIMUM_WAGE	-0.322599	0.484223	-0.666219	0.5057
UNEMPLOYMENT	0.101809	0.048991	2.078121	0.0384
UNEMPLOYMENT_BENEFIT	-0.677311	0.679602	-0.996628	0.3196

Besides economic growth, also the life expectancy and the unemployment rate seem to influence income inequality at a significance level 0f 0.05.

Table 3.1 shows that the minimum value of the GINI is 20.75 while the maximum value is 51.40. This means that an effect of economic growth on income inequality of

2.09 is quite large, since this indicates that when the GINI is at the maximum value of 51.40, a decrease of 3.676 in absolute numbers is a decrease of 4.06% relatively. When the GINI is at the minimum value of 20.75, a decrease of 10.07 is a decrease of 7.16% relatively.

A.4.3 | Developing Countries

Figure A.7: Results of Developing Countries Random Effect Model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	56.18653	5.285526	10.63026	0.0000
D(LOG(GDP))	0.243042	1.045281	0.232513	0.8163
EDUCATIONAL_ATTAINMENT	0.720392	0.227364	3.168448	0.0017
GCF	0.069358	0.034472	2.012011	0.0453
LIFE_EXP	-0.317825	0.085699	-3.708615	0.0003
MINIMUM_WAGE	2.537384	0.643416	3.943616	0.0001
UNEMPLOYMENT	0.253041	0.061811	4.093777	0.0001
UNEMPLOYMENT_BENEFIT	0.413644	0.740950	0.558261	0.5772

Economic growth and unemployment benefit are the only two variables which have no effect on income inequality at a significance level of 0.05.

Bibliography

[Acemoglu, 2001] Acemoglu, D. (2001). Credit market imperfections and persistent unemployment. *European Economic Review*, 45(4):665–679.

[Alesina and Perotti, 1996] Alesina, A. and Perotti, R. (1996). Income distribution, political instability, and investment. *European economic review*, 40(6):1203–1228.

[Alesina and Rodrik, 1996] Alesina, A. and Rodrik, D. (1996). Distributive politics and economic growth. Technical report, National bureau of economic research.

[Banerjee and Duflo, 2003] Banerjee, A. V. and Duflo, E. (2003). Inequality and growth: What can the data say? *Journal of economic growth*, 8(3):267–299.

[Barro, 2000] Barro, R. J. (2000). Inequality and growth in a panel of countries. *Journal of economic growth*, 5(1):5–32.

[Barro, 2001] Barro, R. J. (2001). Human capital and growth. *The American Economic Review*, 91(2):12–17.

[Bourguignon, 2004] Bourguignon, F. (2004). The poverty-growth-inequality triangle. *Poverty, Inequality and Growth*, 69.

[Breen and Jonsson, 2005] Breen, R. and Jonsson, J. O. (2005). Inequality of opportunity in comparative perspective: Recent research on educational attainment and social mobility. *Annual review of sociology*, pages 223–243.

[Brown et al., 1982] Brown, C., Gilroy, C., and Kohen, A. (1982). The effect of the minimum wage on employment and unemployment. *Journal of Economic literature*, 20(2):487–528.

[Causa et al., 2014] Causa, O., de Serres, A., and Ruiz, N. (2014). Focus on inequality and growth.

[Cingano, 2014] Cingano, F. (2014). Trends in income inequality and its impact on economic growth.

[Cobham, 2013] Cobham, A. (2013). Palma vs. gini: Measuring post-2015 inequality. *Center for Global Development Blog*, 4.

[Coulter, 1989] Coulter, P. B. (1989). *Measuring inequality: A methodological handbook*. Westview Press.

[Dabla-Norris et al., 2015] Dabla-Norris, M. E., Kochhar, M. K., Suphaphiphat, M. N., Ricka, M. F., and Tsounta, E. (2015). *Causes and consequences of income inequality: a global perspective*. International Monetary Fund.

[Deininger and Squire, 1996] Deininger, K. and Squire, L. (1996). A new data set measuring income inequality. *The World Bank Economic Review*, 10(3):565–591.

[Forbes, 2000] Forbes, K. J. (2000). A reassessment of the relationship between inequality and growth. *American economic review*, pages 869–887.

[Gallup, 2012] Gallup, J. L. (2012). Is there a kuznets curve. *Portland State University*.

[Hoeller et al., 2014] Hoeller, P., Joumard, I., and Koske, I. (2014). Reducing income inequality while boosting economic growth: Can it be done? evidence from oecd countries. *The Singapore Economic Review*, 59(01):1450001.

[Jones, 1988] Jones, E. L. (1988). *Growth recurring: Economic change in world history*. University of Michigan Press.

[Katz and Meyer, 1990] Katz, L. F. and Meyer, B. D. (1990). The impact of the potential duration of unemployment benefits on the duration of unemployment. *Journal of public economics*, 41(1):45–72.

[Kravis et al., 1978] Kravis, I. B., Heston, A. W., and Summers, R. (1978). Real gdp per capita for more than one hundred countries. *The Economic Journal*, 88(350):215–242.

[Kremer and Maskin, 2006] Kremer, M. and Maskin, E. (2006). Globalization and inequality.

[Kuznets, 1955] Kuznets, S. (1955). Economic growth and income inequality. *The American economic review*, 45(1):1–28.

[Li and Zou, 1998] Li, H. and Zou, H.-f. (1998). Income inequality is not harmful for growth: theory and evidence. *Review of development economics*, 2(3):318–334.

[Milanovic, 2013] Milanovic, B. (2013). Global income inequality in numbers: In history and now. *Global policy*, 4(2):198–208.

[Norton, 2002a] Norton, S. W. (2002a). Economic growth and poverty: in search of trickle-down. *Cato J.*, 22:263.

[Norton, 2002b] Norton, S. W. (2002b). Economic growth and poverty: in search of trickle-down. *Cato J.*, 22:263.

[OECD, 2001] OECD (2001). Glossary of statistical terms @ONLINE.

[Okun, 1975] Okun, A. M. (1975). *Equality and efficiency: The big tradeoff*. Brookings Institution Press.

[Perotti, 1993] Perotti, R. (1993). Political equilibrium, income distribution, and growth. *The Review of Economic Studies*, 60(4):755–776.

[Ravallion, 2001] Ravallion, M. (2001). Growth, inequality and poverty: looking beyond averages. *World development*, 29(11):1803–1815.

[Rubin and Segal, 2015] Rubin, A. and Segal, D. (2015). The effects of economic growth on income inequality in the us. *Journal of Macroeconomics*, 45:258–273.

[UNDP, 2013] UNDP (2013). Humanity divided: Confronting inequality in developing countries.

[Wilkinson, 1992] Wilkinson, R. G. (1992). Income distribution and life expectancy. *BMJ: British Medical Journal*, 304(6820):165.

[World Bank, 2016] World Bank (2016). World bank country and lending groups.

[Yitzhaki, 1979] Yitzhaki, S. (1979). Relative deprivation and the gini coefficient. *The quarterly journal of economics*, pages 321–324.