Inequality and economic growth

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INEQUALITY AND ECONOMIC GROWTH

Undergraduate thesis

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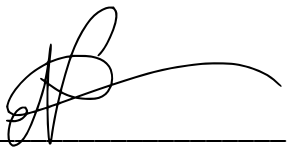
In Zagreb, 15.9.2021. Signature: 

Contents

1 Introduction

1.1 The Object and Purpose of the Paper

The research objective of this paper is to analyse if and how inequality affects economic growth overall, and specifically in the European Union. It does so by describing inequality and economic growth in more detail, overviewing existing research on the topic, and finally conducting cross-sectional analyses using data from year 2017, and drawing conclusions from them. After reviewing existing literature, the major hypotheses of this paper were that income inequality had a positive or no correlation with economic growth overall, and a positive one in the EU. Finally, our results showed negative, but insignificant correlation between inequality and economic growth suggesting that changes in inequality have no significant impact on economic growth and that redistributive policies consequently have insignificant effects on economic growth.

1.2 Sources of data and methodology

Theoretical part of this paper was written using data obtained by secondary research. Resources include published professional reports and papers, and internet resources. Data that was being used for cross-sectional analyses was obtained from the World Bank Database.

1.3 Content and Structure of the Paper

This paper is split into 6 sections: the introduction, definitions of economic growth and inequality, existing literature overview, descriptions of data and model used in research, empirical results, and conclusion. The first chapter, introduction (the current section) contains the object and purpose of the paper, and content and structure of the paper. The second chapter briefly describes definitions and measurements of economic growth and inequality. The third chapter concerns itself with describing data and models used in our cross-section analyses, while the fourth section presents empirical results. Fourth section is divided into two parts: results for overall sample, and results for the European Union. The final chapter is conclusion which contains a summary of this paper and concluding remarks.

2 Economic Growth and Inequality

This section will give a brief overview of definitions and measurements of economic growth and inequality.

2.1 Economic Growth

Economic growth is defined as an increase in the number and quality of economic goods and services produced and consumed by a society. While the definition of economic growth is simple, quantifying it is incredibly challenging. Economic growth is frequently measured as an increase in inflation-adjusted GDP or household income, but it's vital to remember that this isn't the definition – just as life expectancy is a measure of population health, but not the definition (Roser, 2013).

However, there is a need to choose an economic metric that will represent economic growth to allow for an analysis of country's economic growth over time and compare it to those of other countries. In this paper, GDP growth rate will be used as it is one of the most common measures of economic growth. GDP or Gross Domestic Product refers to the total gross value added by all resident producers in the economy. The change in GDP at constant prices is commonly used to measure economic growth. Furthermore, to allow cross-country comparisons of socioeconomic and other data, many other economic indicators use GDP or GDP per capita as a denominator (World Bank, 2020).

2.2 Determinants of Economic Growth

As challenging it is to quantify economic growth, it is further challenging to determine all the factors that influence it. The study of the economic growth theory is very complex and still under revision with new determinants being added to new and advanced models of economic growth. However, theory suggests that there are four major determinants of economic growth: human resources, natural resources, capital formation, and technology (Boldeanu & Constantinescu, 2015). Although the weight that researchers assigned to each determinant was always varied, human resources (growing the active population, investing in human capital), natural resources (land, subterranean resources), the increase in capital employed,

and technical advancements have been found to have a direct influence on economic growth and are therefore considered major determinants. However, indirect factors such as institutions (financial institutions, private administrations, etc.), the size of aggregate demand, saving and investment rates, the efficiency of the financial system, budgetary and fiscal policies, labour and capital migration, and government efficiency also influence economic growth, but their influence is hard to examine (Boldeanu & Constantinescu, 2015).

Inequality is also one of those factors of economic growth that researchers have been examining for years. Both theory and research offer differing views on the effects of inequality on economic growth.

2.3 Inequality

According to Merriam-Webster dictionary, inequality is the quality of being unequal or uneven. Inequality refers to disparities in living standards among a group of people. As with poverty, it is usually easier to analyse the many elements of inequality individually. Education, health, and nutrition, as well as security, power, social inclusion, income or consumption, and assets, are all well-known elements of poverty. Even if the correlation isn't perfect, these several characteristics of inequality are typically related to one another. Patterns of educational disparity, for example, may reflect gender differences, or asset inequalities may be the result of or contribute to political power imbalances. Some inequality is a typical outcome in a market economy because of, for example, the degree to which people take advantage of the possibilities available to them. However, a significant portion of inequality in individuals' circumstances may represent inequality in opportunities, with people being favoured or disfavoured based on where they reside, parental circumstances, gender, and other factors (McKay, 2002). The uneven distribution of wealth and opportunity between various groups in society is referred to as economic inequality. It is a problem in nearly every country, and many individuals are locked in poverty with little opportunities to rise up the social ladder (IZA, 2021).

Household surveys, which are now accessible for many nations, are generally used to collect data for these sorts of characteristics. An inequality index is used to summarize inequality in

such variables. While a vast number of inequality indexes have been established, they all share certain common characteristics. The relative position of various people (or households) within a distribution is the subject of inequality. This means that measurements of inequality should be unaffected by the absolute number of individuals or the measure's average absolute value. In addition, when a minor transfer is made from a richer to a poorer individual, inequality indexes must reflect a reduction in inequality (IZA, 2021). The most commonly used measures are the Lorenz curve, the Gini coefficient, decile ratios, the Palma ratio, and the Theil index. In this paper the Gini coefficient will be used so only this one will be explained in more detail.

To understand how Gini coefficient works, one must first understand the Lorenz curve. Lorenz curve graphically shows income inequality of a country. It is construed on an xy-plane where x represents cumulative percentage of population and y represents cumulative percentage of income earned. The Lorenz curve therefore connects the points which show what percentage of cumulative income is owned by the poorest x percent of population. If income was distributed perfectly even, the Lorenz curve would depict a 45-degree line which is called line of equality. However, in real world such distributions don’t exist, so Lorenz curves tend to be below this line. The greater the inequality, the further Lorenz curve is from the 45-degree line (Trapeznikova).

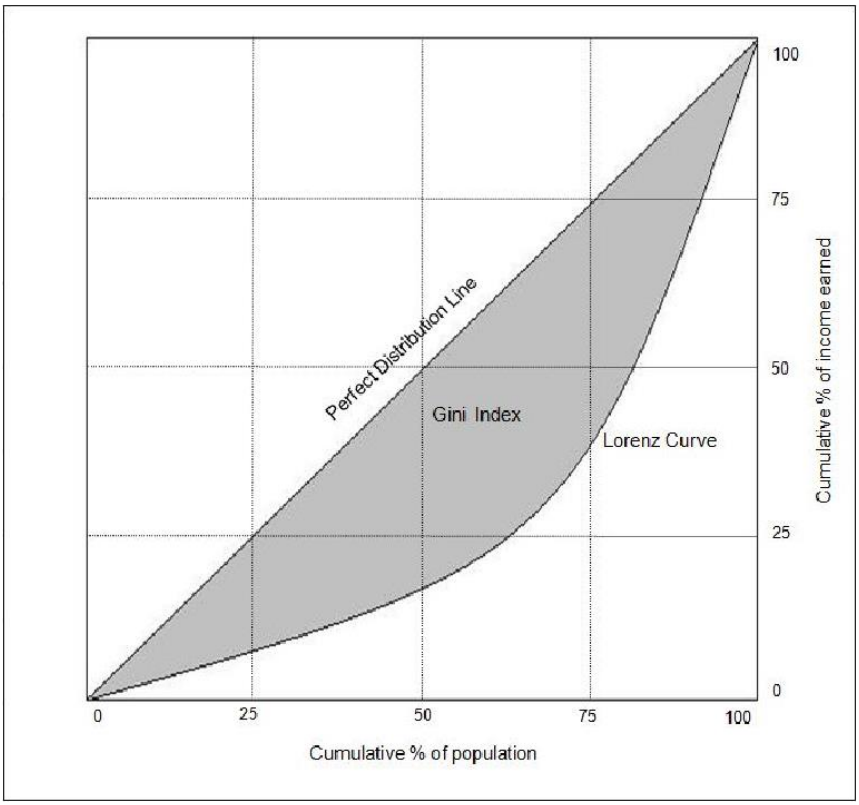


Figure 1 Lorenz Curve and Gini Index (Davis & Cobb, 2010)

After finding the Lorenz curve of the country, the Gini coefficient can be calculated as the quotient of the area between the Lorenz curve and the 45-degree line, and the entire area under the 45-degree line. Gini coefficient can therefore have values ranging from 0 (perfect equality) to 1 (perfect inequality, i.e., one person having all the income). The lower the Gini coefficient, the more equal is the society (Trapeznikova).

2.4 Determinants of Inequality

Equality in society is a noble goal and the way to achieve it depends on drivers of inequality in the first place. In their research, Tica et al. (2021) find that the main determinant of rising inequality is technological progress. This holds true for both lower and higher levels of development and therefore, regardless of the country's level of development, full employment policies and low inflation have a significant effect on reducing inequality. Moreover, they found that globalisation had a minor impact in reducing inequality between

the top and middle-income groups, however only at lower levels of development and not at higher levels.

While examining century-long dynamics of inequality among the US states, Arčabić et al. (2021) found two major channels which contribute to reducing inequality. The first one is access to education, and the second is government economic redistribution measures. With easier access to education (for example, larger quantity of public schools), educational inequality is reduced which consequently reduces income inequality. Furthermore, the top income earners mostly accumulate wealth through capital gains. Redistributive policies including an increase in capital gains tax rate could lessen the wealthy's rapid income growth.

Both Tica (2021) and Arčabić (2021) found that decreasing inequality with one-size-fits-all economic strategies is inefficient when applied across a diverse group of governments and groups and should be tailored accordingly.

Although reducing inequality may seem like an obvious goal, there are various points of view on whether or not economic inequality should be reduced, which range from economic to political to philosophical. The most obvious reason for reducing inequality is based on the principle of fairness, which states that everyone should have an equal opportunity to thrive. On the other hand, some renowned economists have long argued that there is a trade-off between equality and growth (Bhatt et al., 2020). Some economists argue that inequality supports economic growth, while others argue it hinders it. Next section will discuss some of the existing research on the effects of inequality on economic growth.

3 Existing Literature Overview

While examining existing literature, one can find many research papers with completely opposite results of the effects of inequality on the economic growth. One side supports thesis that inequality has a positive impact on economic growth, while others counter it and say that it has a negative impact. Furthermore, some researchers claim that inequality has no impact on the economic growth. The literature is summed up in the following section.

3.1 Inequality has positive or no effect on economic growth

As believed by neoclassical economics there is a trade-off between equality and efficiency. Okun (1975) illustrates transfers from the wealthy to the poor as a "leaky bucket" in which some money is lost as it travels through the leaky bucket. Equality is expected to have an impact on incentives, and legislators must choose between equity and economic efficiency. The rationale for this trade-off, according to Kaldor (1955), is that the rich have a higher marginal tendency to save than the poor. If one considers that GDP growth is proportional to the savings rate, unequal economies will develop faster.

In the short and medium term, Forbes (2000) finds a positive relationship between income inequality and growth. This shows that lowering inequality and enhancing a country's growth performance may be mutually exclusive. Forbes casts doubt on certain prior studies that revealed a negative link, suggesting that they are likely to have econometric flaws such measurement error and omitted-variable bias. Forbes' research focuses on a closer interaction between countries, and they used panel estimation to account for time-invariant country-specific effects.

According to Barro (1999), there is no link between income inequality and growth in general. After splitting his sample into poor and rich countries he discovers a negative correlation for poor countries and a positive correlation for rich countries. He observed that the Gini coefficient had a positive link with GDP growth in nations with a high baseline level of GDP

per capita (over $2000). These findings support distributional policies in poor nations, whereas redistribution in rich countries may result in lower economic growth.

Shin (2012) attempted to make the conflict of existing literature reports understandable within a single framework. Using a theoretical model that is dependent on the stage of development, it was demonstrated that both are possible. Primary findings were that in the early stages of economic development, income inequality has a negative effect on economic growth, but as Barro (2000) points out, income inequality has a positive effect on economic growth approaching a steady state. Disparity was demonstrated within a single model.

Benos and Karagiannis (2017), using an annual panel of state-level data, studied the relationship between economic growth and top income inequality in the United States. They found long-run growth impact of changes in top income and overall inequality to be insignificant for economic growth.

3.2 Inequality has negative effect on economic growth

Inequality, according to Stiglitz (2012), hinders economic growth. Inequality, according to Stiglitz, reduces aggregate demand for people at the bottom, causing them to spend a larger proportion of their income than those at the top. This makes obvious sense; the poor frequently must spend all of their wages simply to meet their basic needs. Furthermore, inequality of outcomes is linked to inequality of opportunity, making it difficult for people from low socioeconomic backgrounds to achieve their full potential. This suggests that income inequality has a detrimental impact on future economic growth, potentially trapping families in poverty. Another key reason in how inequality can hamper growth, according to Stiglitz, is rent seeking, which occurs when the wealthy attempt to increase their own wealth rather than create new wealth.

Over a 30-year period, Cingano (2014) finds a significant, negative association between inequality and economic development in the OECD countries. The difference between low-income households and the rest of the population was shown to be the most important, while

there was no indication that the wealthy separating themselves from the rest of the population harmed growth. Their research found that in unequal societies, the poor invest less in their education and skills, while the investments made by middle and upper classes are not impacted by the inequality. As a result, this suggests that inequality will widen the gap between education and earnings.

In Australia, Kennedy (2017) conducted an analysis for a 70-year period and found a statistically significant negative association between inequality and economic growth as a result of the increasing concentration of income among fewer people. Their study points out that inequality adversely affects economic growth with a couple of years delay.

Finally, Islam and McGillivray (2020) argue that wealth inequality has more adverse effects on economic growth than income inequality. According to their empirical findings, both income and wealth inequality have negative impacts on cross-country economic growth. However, when both income and wealth inequality measures are included in the same specification, the statistically substantial negative impact of wealth inequality on growth persists, demonstrating the dominance of wealth inequality over income inequality in the inequality-growth nexus.

As we can observe from these findings, there still doesn't exist a consensus on inequality's impact on economic growth. Some economists (including Okun (1975), Kaldor (1955), Barro (1999), and Forbes (2000)), strongly advocate for a positive and others (including Stiglitz (2012), Cingano (2014), and Kennedy (2017)) for negative impact of inequality on economic growth. One of the big problems that lead to these differing conclusions is unavailability of data. Although measuring economic growth is difficult, it is now conducted regularly and statistics on it are available for all developed countries and most developing. However, data for inequality isn't as available. It has only started being measured regularly, so developed countries lack historically consecutive data, and some developing countries lack data on inequality altogether. This paper will therefore have the most recent comprehensive data to conduct its analyses.

4 Data and Model

Research objective of this paper is to observe the impact of income inequality on economic growth by conducting a cross-sectional analysis. Two analyses will be made: one using data from 71 countries around the world, and another one which will examine data from the EU countries for the year 2017. According to the existing literature, in the short- and medium-term inequality positively affects economic growth (Forbes, 2000), but when split into developing and developed countries, inequality has negative effect on economic growth for developing countries and positive for developed ones (Barro, 1999; Shin, 2012). However, when observing one of the most developed countries, the USA, no significant correlation was found between income inequality and economic growth (Benos & Karagiannis, 2017). Over long-term, however, literature points out that inequality has negative effect on economic growth.

Since this paper is conducting cross-sectional analysis of different countries at one point in time, we expect that results will behave similarly to the previous research on short-term impact of inequality on economic growth for countries that were not split into groups according to their development. When Forbes (2000) conducted a panel analysis on short and medium term, they found a positive relationship between income inequality and growth. Furthermore, before they split their sample into developing and developed countries, Barro (1999) found no link between income inequality and growth. Therefore, we arrive to our first hypothesis:

Hypothesis 1: Income inequality has a positive or no correlation with economic growth overall.

The second hypothesis concerns our research on the EU. Since this paper is conducting cross-sectional analysis of a developed region at one point in time, we expect that results will behave similarly to the previous research on short-term impact of inequality on economic growth in developed countries. When Barro (1999) split their sample into developing and developed countries, they observed that rich nations have a positive correlation between Gini coefficient and economic growth. Therefore, we arrive to our second hypothesis:

Hypothesis 2: Income inequality has a positive correlation with economic growth in the EU.

4.1 Model

A regression analysis is used to look at changes in economic growth caused by income inequality in 2017 for 71 countries of the world. These include both developed and developing countries and the selection was made by observing which countries have available data on inequality for the year 2017. For the second part of the paper which concerns itself with the EU, a regression analysis is also used to look at changes in economic growth caused by income inequality in 2017 for 25 countries of the European Union. Germany and Slovakia were excluded from the research, even though they are in the EU, because they lack data for 2017. Variables for both analyses were created using 2017 data and gathered from the World Bank Database. Cross-sectional data is used in this study. To account for other economic aspects or variables that may impact economic growth several multiple regression models were created. To account for the Gini coefficient, these additional variables were chosen: gross savings rate, unemployment rate, human capital index, lagged GDP per capita, and lagged GDP growth rate. These variables, along with the Gini coefficient, were used to regress GDP growth.

Based on the theoretical framework and previous research, following models were created and then evaluated using an OLS regression:

Model 1: $\hat{Y} = \beta_0 G + \varepsilon$

Model 2: $\hat{Y} = \beta_0 G + \beta_1 S + \varepsilon$

Model 3: $\hat{Y} = \beta_0 G + \beta_1 S + \beta_2 Unemp + \varepsilon$

Model 4: $\hat{Y} = \beta_0 G + \beta_1 S + \beta_2 Unemp + \beta_3 HCI + \varepsilon$

Model 5: $\hat{Y} = \beta_0 G + \beta_1 S + \beta_2 Unemp + \beta_3 HCI + \beta_4 lagYpc + \varepsilon$

Model 6: $\hat{Y} = \beta_0 G + \beta_1 S + \beta_2 Unemp + \beta_3 HCI + \beta_4 lagYpc + \beta_4 lagY + \varepsilon$

where

$\hat{Y} = \ GDP\ Growth$

$G = Gini\ Coefficient$

$S = Gross\ Savings$

$Unemp = Unmployment$

$HCI = Human\ Capital\ Index$

$lagYpc = lagged\ GDP\ p.c.$

$lagY = lagged\ GDP\ Growth$

4.2 Data

Variables that are being used in this model weren't chosen at random. The next part explains what each variable represents and why it was used.

GDP Growth represents annual percentage growth rate of GDP at market prices based on constant local currency. Aggregates are based on constant 2010 U.S. dollars. GDP is 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.

Gini Coefficient measures the deviation from a perfectly equal distribution of income across individuals or families within an economy. Starting with the poorest individual or household, a Lorenz curve shows the cumulative percentages of total income received against the cumulative number of recipients. The Gini coefficient measures the area between the Lorenz curve and a hypothetical line of absolute equality, expressed as a percentage of the maximum area under a hypothetical line of absolute equality. As a result, a Gini index of 0 denotes perfect equality, whereas a value of 100 denotes perfect inequality. It was chosen because it is one of the most common and easily accessible measures of inequality. Data is expressed in percentages.

Gross Savings are calculated as gross national income less total consumption, plus net transfers. It is expressed as a percentage of GDP. Because it represents a country's ability to consume and save, gross savings is one of the most popular measures of growth.

Unemployment refers to the percentage of the labour force that is unemployed yet looking for job. The working-age population is defined as those aged 15 and up. Unemployment rate is one of the most direct indicators of country's economic health. Data is expressed in percentage of total labour force.

Human Capital Index calculate how much health and education contribute to worker productivity. The final index score, which runs from zero to one, assesses the productivity of a child born today as a future worker in comparison to the benchmark of full health and complete education. It is included since the theory states that human capital influences economic growth.

GDP per capita is gross domestic product divided by midyear population. GDP is calculated as the total gross value contributed by all resident producers in the economy, plus any product taxes, minus any subsidies not included in the product value. It is expressed in 2010 U.S. dollars so it can be used to compare different countries over time.

Lagged values indicate that the variable represents value for an earlier point in time. In this paper lagged values represent values for one year before, or 2016. Lagged values are used since countries' richness and former growth impact current economic growth.

Here we list the names of all countries which data has been used in this paper:

Albania	Djibouti	Kazakhstan	Romania
Argentina	Dominican Republic	Kyrgyz Republic	Russian Federation
Armenia	Ecuador	Latvia	Sao Tome and Principe
Austria	Egypt, Arab Rep.	Lesotho	Serbia
Belarus	El Salvador	Lithuania	Slovenia
Belgium	Estonia	Luxembourg	Somalia
Bhutan	Finland	Malta	Spain
Bolivia	France	Mauritius	Sweden
Brazil	Gabon	Moldova	Switzerland

Bulgaria	Georgia	Myanmar	Tanzania
Canada	Greece	Netherlands	Thailand
Chile	Honduras	North Macedonia	Turkey
Colombia	Hungary	Norway	Ukraine
Costa Rica	Iceland	Panama	United Kingdom
Croatia	Indonesia	Paraguay	United States
Cyprus	Iran, Islamic Rep.	Peru	Uruguay
Czech Republic	Ireland	Poland	Zimbabwe
Denmark	Italy	Portugal	

When research effects of inequality in the EU, we use data from 25 out of 27 EU countries. The reason behind that is that some of the data for year 2017 wasn't available for 2 EU countries: Germany and Slovakia. Below we list the names of all countries which data was used when examining effects of inequality in the EU:

Austria	Estonia	Latvia	Romania
Belgium	Finland	Lithuania	Slovenia
Bulgaria	France	Luxembourg	Spain
Croatia	Greece	Malta	Sweden
Republic of Cyprus	Hungary	Netherlands	
Czech Republic	Ireland	Poland	
Denmark	Italy	Portugal	

5 Empirical Results

This section will present and explain empirical results obtained through this research. All models passed diagnostic checking (VIF, Breusch-Pagan, Durbin-Watson, Breusch-Godfrey, and Jarque-Bera tests). First, we will present the findings for overall country sample, and then for the EU countries.

5.1 Overall sample

Table 1 contains summary statistics.

Summary Statistics

Variable	N	Mean	Std. Dev.	Min	Max
Y	71	3.598	2.001	-3.142	9.129
Gini	71	36.045	7.405	24.2	56.3
S	67	22.354	6.275	10.026	35.081
Unemp	71	7.992	5.024	0.83	24.13
HCI	65	0.656	0.116	0.371	0.814
lagYpc	69	21078.50	23579.05	904.41	110162.12
lagY	71	2.998	2.451	-3.276	13.396

Table 1 Summary Statistics, overall

71 countries were included in this research. Lagged GDP p.c. wasn't available for 2 countries, gross savings rate wasn't available for 4 countries, and human capital index for 6 countries in year 2017. Gini coefficient mean is 36.045%, with standard deviation of 7.405. This indicates big differences in inequality among observed countries. Furthermore, values of lagged GDP p.c. show big differences in the richness and development of countries as well. It has a range

from 904.41 US dollars per capita for Tanzania, to 110,162.12 US dollars per capita for Luxembourg. An extreme outlier for lagged GDP growth rate is Iran with 2016 GDP growth rate of 13.396%.

In figure 1, we can observe the top and bottom 5 countries according to Gini coefficient from the observed sample.

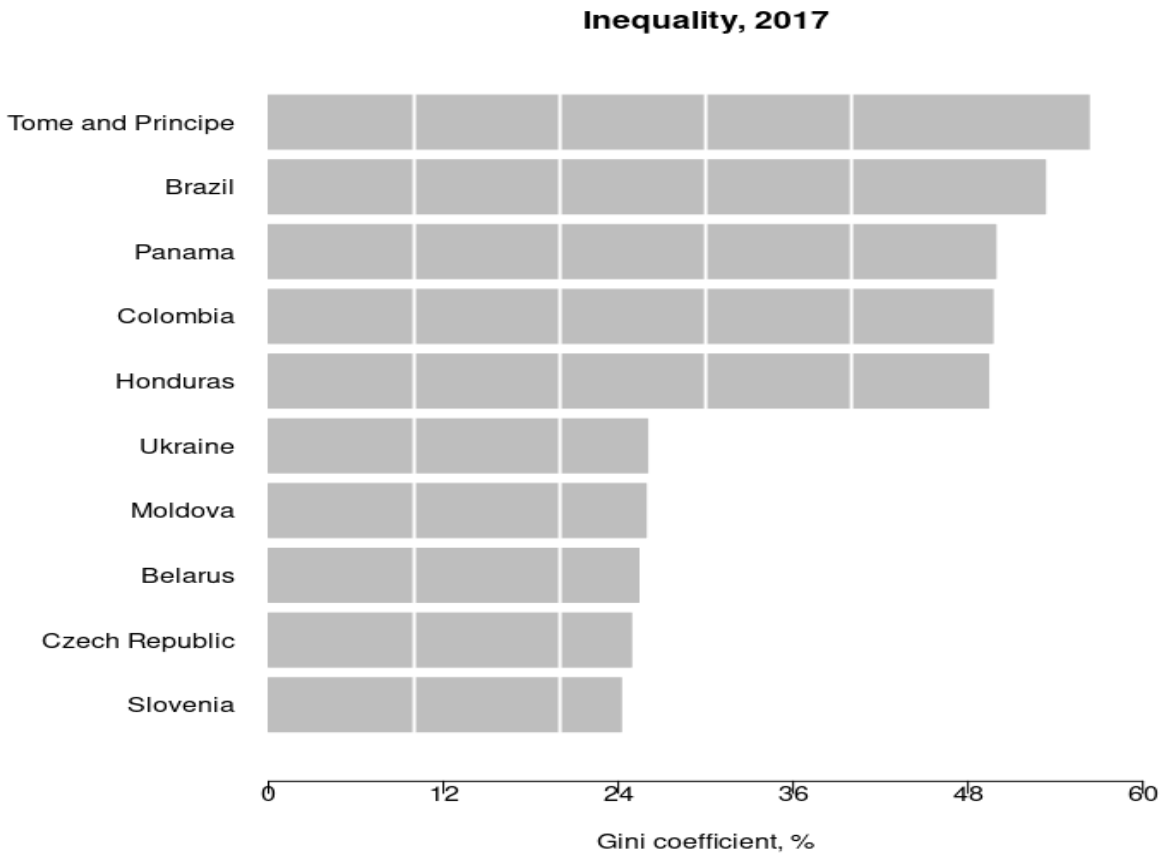


Figure 2 Inequality 2017, (sample) top and bottom 5

When observing the scatterplot between GDP growth rates and Gini coefficients presented in Figure 2, the fitted line indicates a slight negative relationship. Most countries have positive growth rates, ranging between 2 and 6 per cent, while Gini coefficients aren't condensed. Lesotho, a country in Southern Africa, is an extreme outlier with a growth rate of -3.192%. On the other hand, when observing a scatterplot between GDP p.c. and Gini coefficient, presented in figure 3, we can see a pronounced negative trend indicating that poorer countries are also more unequal to begin with.

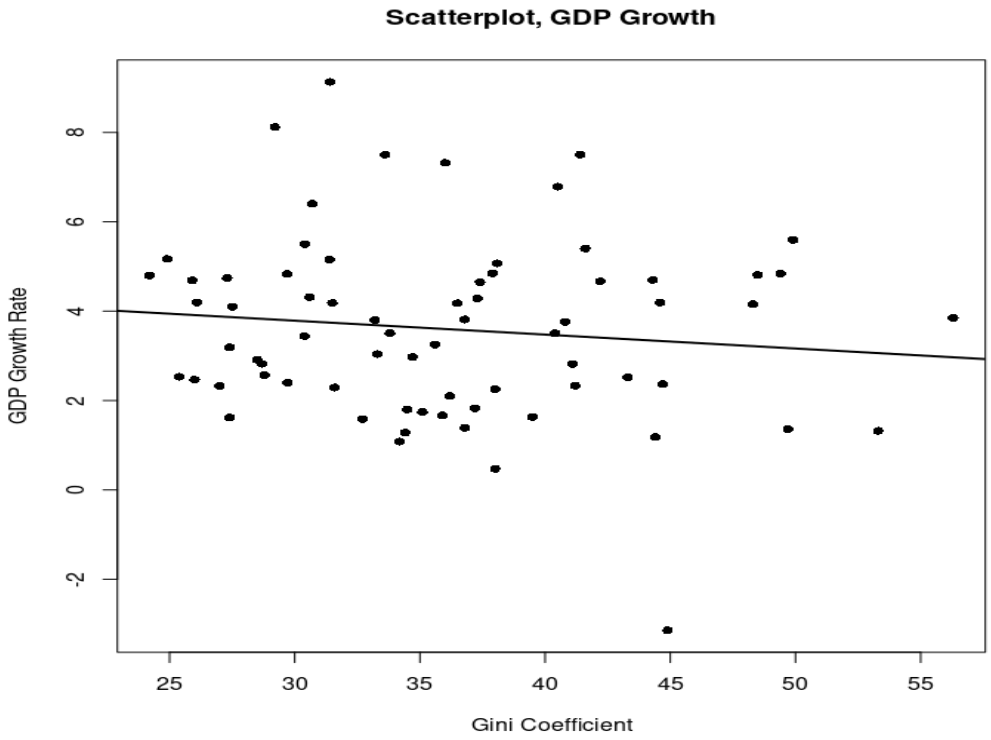


Figure 3 Scatterplot, GDP Growth and Gini Coefficient

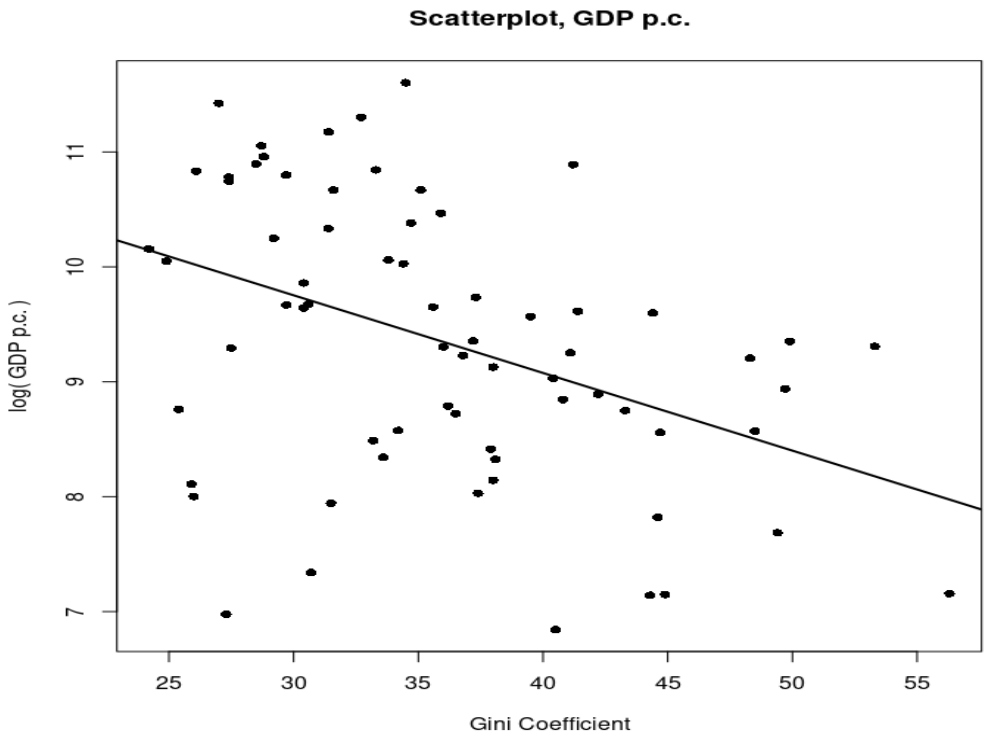


Figure 4 Scatterplot, GDP p.c. and Gini Coefficient

Regression analysis

An OLS model was used to see how income inequality and the controllable variables connect to GDP growth over 71 countries. According to the results, Gini coefficient has a small, negative impact on the GDP growth rate, but it is only significant in model 5. The regression findings are reported in Table 2. Significance of 10%, 5% and 1% is noted with *, **, and ***, respectively.

	Dependent variable:					
	Y					
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Constant	4.7209***	1.5878	3.2854*	8.8230***	6.7026**	3.4699
	(1.1889)	(1.7407)	(1.8912)	(3.0560)	(3.1083)	(3.4184)
Gini	-0.0311	-0.0064	-0.0093	-0.0675	-0.0664*	-0.0407
	(0.0323)	(0.0347)	(0.0339)	(0.0409)	(0.0395)	(0.0405)
S		0.1034**	0.0685	0.0737*	0.0872**	0.0768*
		(0.0396)	(0.0422)	(0.0429)	(0.0419)	(0.0411)
Unemp			-0.1070**	-0.1173**	-0.1232**	-0.1014*
			(0.0524)	(0.0531)	(0.0515)	(0.0513)
HCI				-5.3308**	-1.5946	0.9284
				(2.5279)	(2.9704)	(3.1469)
lagYpc					-0.00003**	-0.00003**
					(0.00001)	(0.00001)
lagY						0.2672**
						(0.1314)
Observations	71	67	67	63	63	63
R^2	0.0133	0.1099	0.1652	0.2365	0.2972	0.3455
Residual Std. Error	2.0023	1.9208	1.8748	1.8488	1.7893	1.7421
Note:	*p<0.1; **p<0.05; ***p<0.01					

Table 2 Regression analysis, overall

GDP Growth and Gini coefficients are examined in model 1. Beta value of -0.0311 indicates a slight negative relationship, which we have seen in the scatterplot. Meaning behind this beta value is that one-unit rise in Gini Coefficient would result in 0.0311 lower GDP growth rate. R2 value indicates what percentage of the dependant variable can be explained by the model. In this case, R2 of the model is 0.0133 implying that the Gini coefficient explains only 1.33% of GDP growth in the model. When doing a basic bivariate study on GDP Growth, Gini coefficient is negligible. As a result, when all other independent factors are eliminated, we cannot conclude whether there is a link between the two variables.

Model 2 included gross savings rate into the equation. In model 2, Gini coefficient was again negative and insignificant, while savings rate had beta value of 0.1034 significant on 5% level. This is in line with theory, where higher savings rates have positive impact on economic growth. The R2 value for Model 2 is 0.1099, which is higher than the R2 value of 0.0133 for Model 1.

Model 3 further included unemployment rate. With this model, both Gini and gross savings rate are insignificant, while unemployment rate is significant at 5% level and has a beta value of -0.1070. Negative beta value is as expected, since higher unemployment should hinder economic growth. R2 value of this model is 0.1652.

Model 4 included all the previous variables and added human capital index. With this model, gross savings rate, unemployment rate and human capital index are all significant, while Gini coefficient is not. Beta value of gross savings is 0.0737 at 10% significance and beta values of unemployment rate and human capital index are both significant at 5% level and equal -0.1173 and -5.3308 respectively. Negative beta value of human capital index is unexpected and could be possibly explained by the heterogeneity of the nations studied. R2 grew and amounted to 0.2365 with model 4.

Model 5 introduces lagged values of GDP per capita. In this model, all variables are significant with the exception of human capital index. Savings rate, unemployment and lagged GDP p.c. values are both significant at 5% level and are equal to 0.0872, -0.1232 and -0.00003 respectively. Negative beta coefficient of GDP p.c. indicates that more developed countries

have slower economic growth. Gini coefficient equals -0.0664 and is significant at 10% level. This is the only model in which Gini coefficient shows significance. R2 of the model is 0.2972.

Finally, model 6 introduces our last variable, lagged GDP growth. In this model, Gini coefficient is again insignificant, as is human capital index. Beta values of lagged variables of GDP p.c. and GDP growth rate are significant at 5% level and amount to -0.00003 and 0.2672. This indicates that current GDP growth rate is a good indicator of future economic growth. Savings rate's beta value is 0.0768, unemployment rate's beta value is -0.1014, both of which are significant at 10% level. R2 of this model is 0.3455.

According to our findings, Gini coefficient is either insignificant or has a slight negative impact on GDP growth. This is somewhat in line with our hypothesis which states that inequality doesn't have an impact or has a positive one. For the most part, our Gini Coefficient was insignificant, however the part that is inconsistent with our hypothesis is the slight negative impact it showed. This could potentially be explained by the state of development of the sample countries that were used in this paper. According to previous research, developing countries show a negative correlation between Gini coefficient and economic growth (Barro, 1999; Shin, 2012). Therefore, our sample could have had more developing countries in it which made Gini coefficient act in that way. On the other hand, this finding is in line with Stiglitz (2012) who argues that inequality, by reducing aggregate demand and opportunities for prosperity, hinders economic growth. Moreover, research focusing on long-term effects (Cingano, 2014) showed that income inequality has a negative impact on economic growth.
Current findings imply that an increase in inequality won't have a significant impact on economic growth or could have a small negative one. Further research should be made by separating the sample into developing and developed countries and seeing the impact of Gini coefficient in those groups.

5.2 EU countries

Out of the 27 countries of the EU, we examined 25. Germany and Slovakia were excluded from this research since they lacked some of the data for the year 2017. Summary statistics for EU countries can be seen in table 3.

Summary Statistics

Variable	N	Mean	Std. Dev.	Min	Max
Y	25	3.914	2.011	1.281	9.129
Gini	25	31.476	3.936	24.2	40.4
S	25	23.765	5.48	10.026	35.081
Unemp	25	7.858	4.176	2.89	21.49
HCI	25	0.745	0.05	0.601	0.814
lagYpc	25	34265.68	23174.05	8012.51	110162.12
lagY	25	2.749	1.381	-0.49	6.438

Table 3 Summary Statistics, EU

Gini coefficients mean for this sample is 31.476%, with standard deviation od 3.936. Comparing to the previous sample, EU countries exhibit a lower overall inequality and less differences among them. Lagged values of GDP per capita still show great differences with mean of 34,265.68 US dollars and standard deviation of 23,174.05. However, the mean value is greater than the one from previous sample. Unemployment rate is the greatest in Greece and amounts to 21.49%, while it is the lowest in Czech Republic at 2.89%.

Inequality in the EU by country can be seen in figure 4.

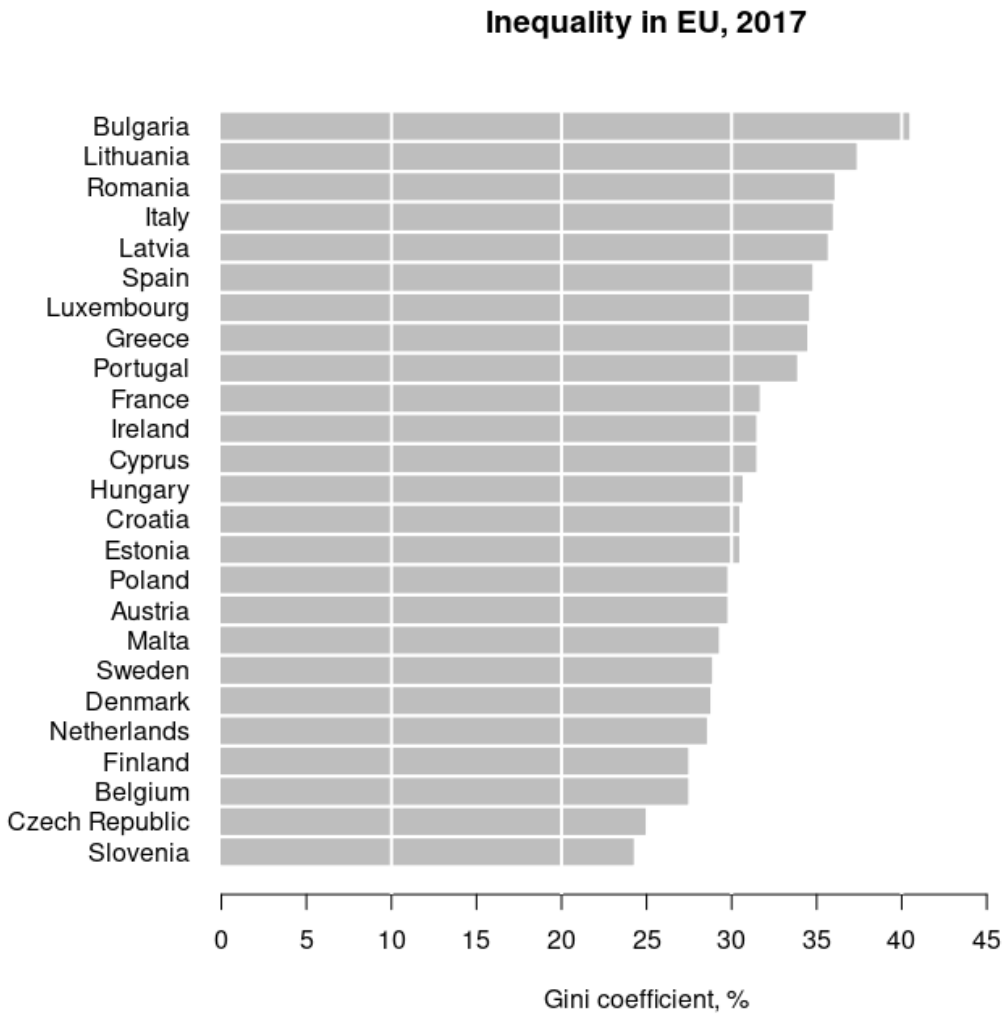


Figure 5 Inequality in the EU, 2017

When observing the scatterplots between Gini coefficients and GDP growth, and GDP p.c. shown in figures 5 and 6, the fitted lines indicate a negative relationship. All countries have positive growth rates, and most of them are in range between 2 and 6 per cent, while Gini coefficients aren't condensed. Figure 6 has one extremely visible outlier with a higher value of Gini coefficient and an extremely high values of GDP p.c. which represents Luxembourg. These scatterplots indicate that inequality has a slight negative effect on economic growth and that poorer or less developed countries in the EU are also more unequal.

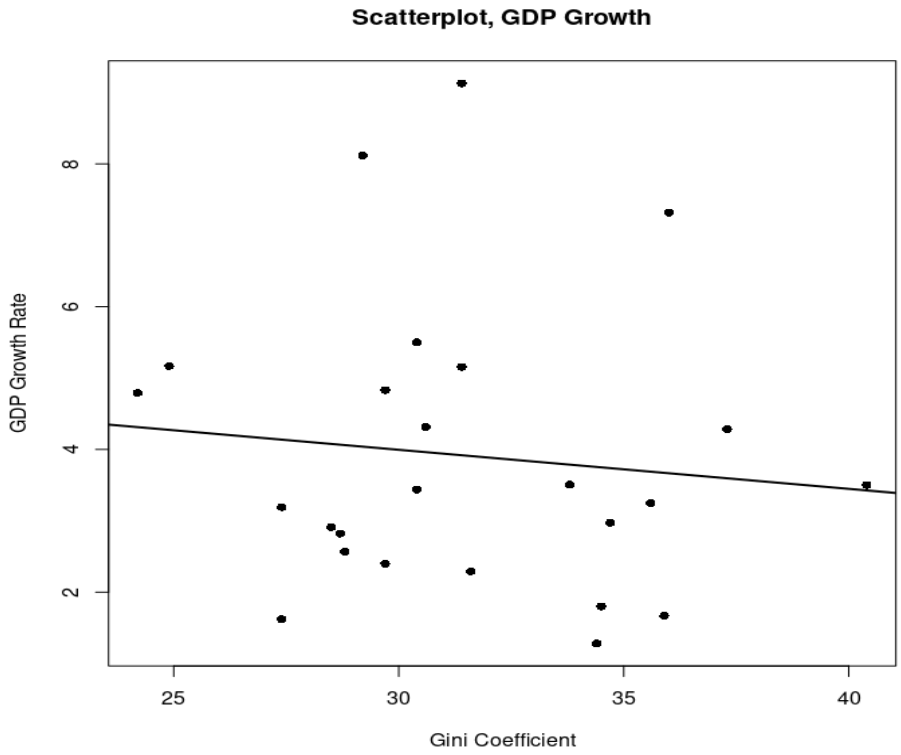


Figure 6 Scatterplot EU, GDP Growth

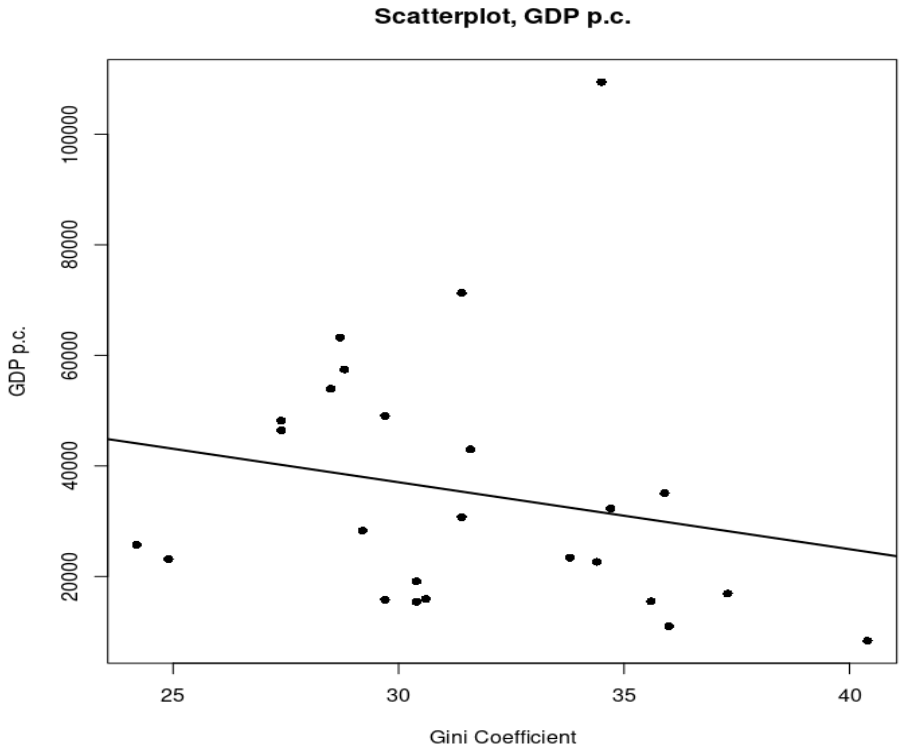


Figure 7 Scatterplot EU, GDP p.c

Regression analysis

An OLS model was used to see how income inequality and the controllable variables connect to GDP growth in the EU countries. Examining the histogram of GDP growth rates, we can see that the distribution of the dependent variable is positively skewed, so logged values of the dependent variable were taken. Logged values of GDP growth rate show a normal distribution. Both of these distributions can be seen in figures 7 and 8.

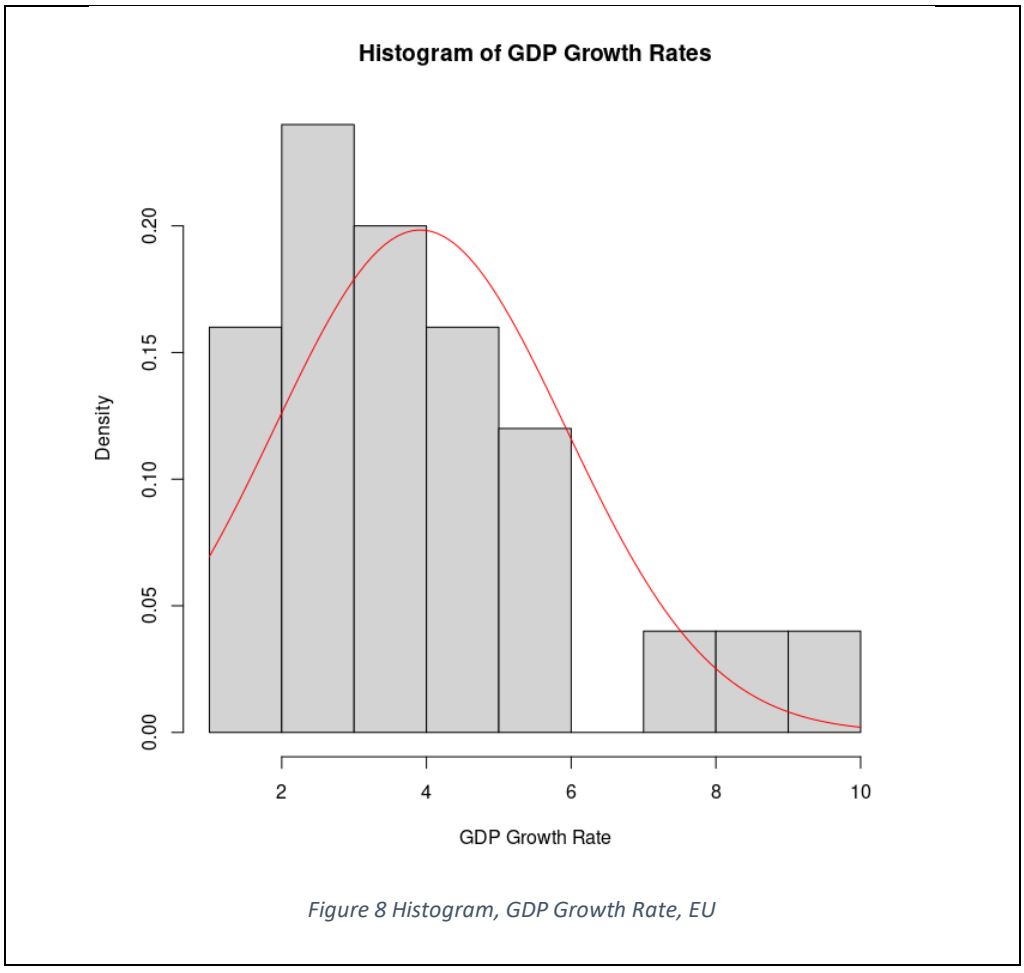


Figure 8 Histogram, GDP Growth Rate, EU

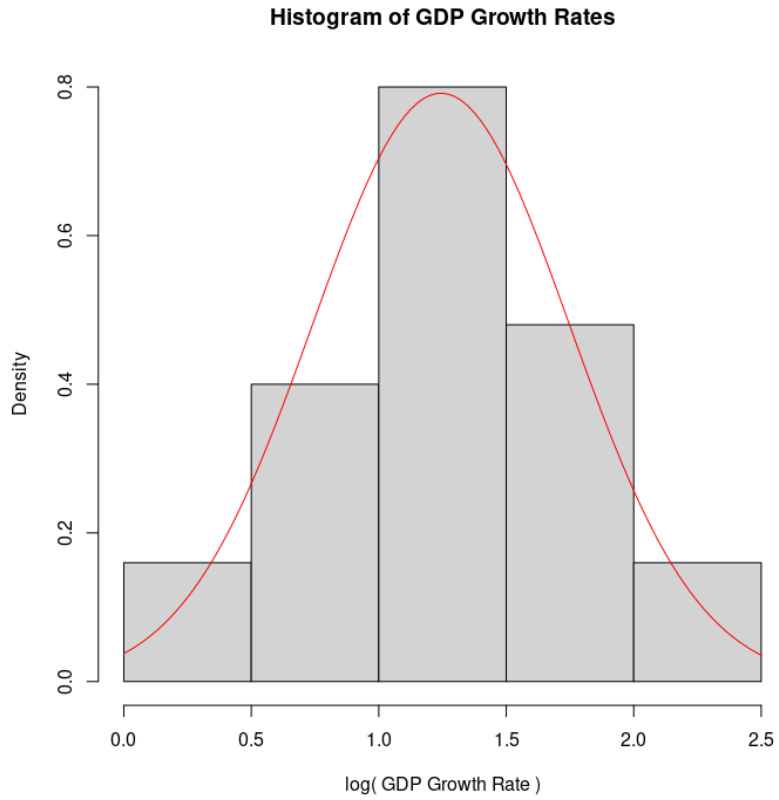


Figure 9 Histogram, GDP Growth Rate, EU (log values)

Models for this analysis were slightly changed. Model 1, as with the previous sample, contains only one independent variable, which is Gini coefficient. Model 2 contains all the independent variables listed in the Data and Model section. Models 3-5 were created to examine the effect of the exclusion of insignificant variables. According to the results, Gini coefficient is insignificant in connection to GDP growth in the EU. The regression findings are reported in Table 2. Significance of 10%, 5% and 1% is noted with *, **, and ***, respectively.

	Dependent variable:				
	log(Y)				
	Model 1	Model 2	Model 3	Model 4	Model 5
Constant	1.7961**	0.5801	0.4509	0.6000	0.1722
	(0.8386)	(2.0688)	(0.9386)	(2.0381)	(0.8447)
Gini	-0.0175	-0.0043	-0.0034	-0.0081	-0.0053
	(0.0264)	(0.0247)	(0.0202)	(0.0237)	(0.0198)
S		0.0367*	0.0362**	0.0439***	0.0430***
		(0.0187)	(0.0172)	(0.0150)	(0.0142)
Unemp		-0.0161	-0.0165		
		(0.0241)	(0.0229)		
HCI		-0.1509		-0.4757	
		(2.1387)		(2.0516)	
lagYpc		-0.00001**	-0.00001***	-0.00001**	-0.00001***
		(0.000003)	(0.000003)	(0.000003)	(0.000003)
lagY		0.1798***	0.1808***	0.1939***	0.1984***
		(0.0595)	(0.0561)	(0.0548)	(0.0499)
Observations	25	25	25	25	25
R^2	0.0188	0.6368	0.6367	0.6278	0.6268
Residual Std. Error	0.5099	0.3507	0.3414	0.3455	0.3373
Note:	*p<0.1; **p<0.05; ***p<0.01				

Table 4 Regression analysis, EU

Model 1, as stated, examines GDP Growth and Gini coefficients. Beta value of -0.0175 indicates a slight negative relationship, which we have seen in the scatterplot. Meaning behind this beta value is that one-unit rise in Gini Coefficient would result in (exp(-0.0175) - 1)*100 = -1.73% lower GDP growth rate. R2 value indicates what percentage of the dependant variable can be explained by the model. In this case, R2 of the model is 0.0188 implying that the Gini coefficient explains only 1.88% of GDP growth in the model. When doing a basic bivariate study on GDP Growth, Gini coefficient is negligible. As a result, when all other independent factors are eliminated, we cannot conclude whether there is a link between the two variables.

Model 2 included all other independent variables: gross savings rate, unemployment rate, human capital index, lagged GDP per capita, and lagged GDP growth rate. The R2 of this model is much higher and is equal to 0.6368. Beta value of lagged GDP growth rate is significant on 1% level and is equal to 0.1798. This implies that one-unit rise in GDP growth rate will cause a 19.70% increase in next year's growth rate. Beta value of lagged GDP per capita is significant at 5% level and implies -0.001% impact on GDP growth. Savings rate is significant at 10% level and its one-unit increase impacts GDP growth rate positively by 3.74%. Beta value of Gini coefficient is negative, but insignificant.

In model 2, Gini coefficient, unemployment rate and human capital index were insignificant, so in models 3-5 we examined what effects had the exclusion of the last two variables. We excluded human capital index in model 3. With this exclusion, unemployment rate and Gini coefficient both remained insignificant. The R2 values of the model almost hasn't changed at all from the previous one and amounts to 0.6367. Beta value of lagged GDP p.c. remained the same as in model 2, but its significance increased and is now significant at 1% level. Savings rate significance also increased, and its beta value is now significant on 5% level with almost the same value.

Model 4 includes unemployment but excludes human capital index. With this model, both savings rate and lagged GDP growth value are significant at 1% level, but the significance of lagged GDP p.c. dropped to 5% level. Saving rate here has a beta value of 0.0439 meaning

that one-unit increase in savings rate increases GDP growth rate by 4.49%. Human capital index and Gini coefficient remained insignificant. R2 value dropped a little and is now 0.6278.

In model 5, both unemployment and human capital index were dropped and. In this model Gini coefficient is again insignificant, but savings rate, lagged GDP per capita and lagged GDP growth rate were all significant on 1% level. With this model, one-unit increase in savings rate and lagged GDP growth rate increases GDP growth by 4.39% and 21.95% respectively, while lagged GDP per capita decreases it by 0.001%.

According to our findings, Gini coefficient shows a slight negative but insignificant impact on GDP growth. This is not in line with our hypothesis which states that inequality has a positive impact on economic growth in the EU. However, this is in line with theory which suggests that inequality has a negative impact on economic growth due to poorer people having to use their money for basic needs and not having enough money to invest which would support economic growth (Stiglitz, 2012). Furthermore, it is in line with research made in another developed region, USA, which found inequality having an insignificant impact on growth (Benos & Karagiannis, 2017). These findings suggest that changes in inequality have no significant impact on economic growth and that redistributive policies consequently have insignificant effects on economic growth through that channel.

6 Conclusion

Economic growth theory is a complicated subject that is continually being researched, with new factors being added to new and improved models of economic growth. Inequality is yet another element of economic growth that has been the subject of years of research. On the consequences of inequality on economic growth, both theory and evidence give opposing viewpoints. Research objective of this paper was to determine the impact of income inequality on economic growth with cross-sectional analysis of countries around the world with data from 2017. After reviewing existing literature, the major hypotheses of this paper were that income inequality had a positive or no correlation with economic growth overall, while a positive one for EU specifically. For 71 countries throughout the world, a regression analysis was performed to look at impact of income inequality in 2017. These nations are both developed and developing, and the list was compiled by looking at which countries provided statistics on inequality for the year 2017. For the research on EU, 25 countries were used, excluding Germany and Slovakia for the lack of data. The World Bank Database was used to construct all variables, which were based on 2017 data. To account for the Gini coefficient, these additional variables were chosen: gross savings rate, unemployment rate, human capital index, lagged GDP per capita, and lagged GDP growth rate. These variables, along with the Gini coefficient, were used to regress GDP growth. According to our results, Gini coefficient is either negligible or has a modest negative influence on GDP growth overall. This is somewhat consistent with our hypothesis, which argues that inequality has either a positive or no significance. Our Gini Coefficient was insignificant for most models, but the minor negative impact it indicated was conflicting with our hypothesis. This might be explained by the stage of development of the nations included in this study's sample. According to prior research, inequality has a negative influence on economic growth in developing nations, therefore our sample could have included more developing countries, causing the Gini coefficient to behave in this way. Furthermore, concerning the EU, Gini coefficient showed a slight negative but insignificant impact on GDP growth. This is not in line with our hypothesis which stated that inequality has a positive impact on economic growth in the EU. Further examination should be done to explain why this is the case. However, there are theories that suggest that inequality hinders economic growth by reducing aggregate demand and

opportunities for prosperity. Finally, these findings implicate that an increase or a decrease in inequality won't have a significant impact on economic growth and accordingly neither will redistributive policies.

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