Does income inequality matter for economic growth? : An empirical investigation

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Abstract

In this paper we empirically investigate a possible effect of income inequality on growth. Using a panel of 126 countries for the time-span from 1968 to 2007 we report a positive relationship between income inequality and growth. That occurs through both the taxation and the human capital channels. We estimate our model with several estimation techniques such as fixed effects, GMM and Two stages least squares. Our results suggest that a policy maker has to take into account a certain trade off between making the distribution of income more equal and raising the economy's wealth.

Keywords: growth, inequality, welfare

JEL Codes: O11, O40, D63

1. Introduction

Economics is the social science that studies economic activity to gain an understanding of the processes that govern the production and the distribution of wealth in an economy. In other words the main goal of economic science is to answer two important questions, how an economy can increase its production, and how this production has to be distributed. Those two important parameters of an economy's welfare are represented by the concepts of economic growth and income inequality, with economic growth representing the increase of production and income inequality representing the distribution of wealth or income respectively.

Despite the fact that, for many years economists focused on evaluating the welfare of an economy as a function of its wealth, the importance of income inequality on producing welfare is not to be undermined. Quoting Thomas Piketty "Indeed, the distribution of wealth is too important an issue to be left to economists, sociologists, historians, and philosophers." With this study we are trying to both find evidence of how income inequality affects growth and provide any possible policy making implications. A negative relationship could create a great incentive for a policy maker to target the rapid decline of income inequality. On the other hand, a positive relationship indicates that a policy maker has to take into account a trade off, in order to maximize the social welfare. Therefore, economies have to choose between reducing income inequality and increasing their wealth. Different societies have to choose between reducing income inequality and increasing their wealth according to the unique characteristics of its own welfare function.

This paper is an empirical investigation of how income inequality affects economic growth. Using panel data analysis we form a model that allows us

predict a positive relationship between income inequality and growth. We formulate our argument using three alternative specifications in our model, introducing fixed effects and estimating the coefficients with both GMM estimators and Two stages least squares estimators. The Two stages least squares estimation procedure is used in order to be sure that a possible endogeneity of income inequality does not affect the results. Thus, from a policy perspective, a society has to take into account a trade off between increasing its wealth and reducing the inequality of its distribution.

The paper is structured as it follows: Section 2 reviews the literature on the subject of how income inequality is associated with growth. Section 3 presents our empirical analysis with subsection 3.1 presenting the methodology used in our econometric analysis and subsections 3.2 and 3.3 presenting our data and our results respectively. Lastly, section 4 provides the concluding remarks of our investigation.

2. Previous studies

Two of the central and most important themes that researchers and the economic science in general emphasize on, is how economies can both increase their wealth and distribute it properly. In other words economic growth and income inequality are two of the most critical parameters that affect the welfare of a society. That being said, a certain question arises. Do levels of income inequality in an economy affect its growth rates and if there is a causal relationship is it negative or positive? A possible negative relationship (if a decline in income inequality leads to greater growth rates) creates a great incentive for a policy maker to target the rapid decline of income inequality. If on the other hand the possible relationship is positive, a policy maker has to take into account a certain trade off before making any decisions, in order to maximize the social welfare in a given economy. This section is a literature review on the relationship between inequality and growth for both possible causalities, in order to provide a better background for examining a possible relationship.

Many studies have found a significant negative causal relationship between income inequality and economic growth, including the attempts to approach the matter theoretically, made by both Persson and Tabellini (1994) and Alesina, Rodrik (1994). Both Persson, Tabellini 's (1994) and Alesina, Rodrik 's (1994) papers can be thought as a turning point in the literature, because of the fact that they investigate a possible causal relationship which indicates that income inequality affects economic growth and not vice versa. Their findings suggest a negative effect of income inequality on growth.

The same results also occur for Birdsall, Ross and Sabot (1995), Alesina and Perotti (1996) and Bloom Canning and Sevilla (2001). Later, Herzer and Vollmer (2012), while detecting several problems in the existing literature on the matter of how inequality affects growth, such as omitted variable bias, country specific heterogeneity, endogeneity (if there exists a Kuznets or an anti Kuznets curve), averaging of data, etc. Also, according to Halter, Oechslin and Zweimuller (2014), inequality affects the efficiency in an economy through many mechanisms either harmful or not. In general their findings are similar to the results of Herzer and Vollmer (2012) but they provide a different interpretation and intuition. In their opinion the negative relationship occurs because investment in human capital could be lower for unequal income distributions in the presence of credit market imperfections. This leads the economy to inefficiency because of the fact that there is less stock of human capital in equilibrium and so, less efficient production. In other words due to credit market imperfections, a poor but future productive worker (if his human capital stock is high), is not allowed to be productive because he does not have access to the opportunity of invest in human capital (for example a student who does not have access to student loans). So in the next period that worker will be less productive and so will produce less product, than the product if the investment on human capital was easier.

Despite the fact that many studies have found a significant negative relationship, there also exists extensive literature supporting the possible positive effect of income inequality on growth. Li and Zou (1998), via considering a more general theoretical framework than Alesina and Rodrik (1994), find that income inequality is positively and most of the time significantly associated with economic growth.

Thus, their results stand in sharp contrast to the significant negative association between inequality and growth found by both Alesina, Rodrik (1994) and Persson, Tabellini (1994). Also, Forbes (2000) analyzing 180 observations for 45 countries in the period from 1966 to 1995 concludes that an increase in income inequality levels leads to greater economic growth for a given country, while she notes that the quality of data according to the gini coefficient as well as the choice of the time span tend to influence the results.

Lastly, not only the presence of papers supporting both the negative and the positive relationship is strong but also the majority of studies on the subject conclude to ambiguous results. Partridge (1997), Barro (2000), Banerjee and Duflo (2003), Schipper and Hoogeveen (2005) and Voitchovsky (2005), produce the integrated conclusion that there is a potential limitation on the investigation because of the complex nature of the relationship. Because of the fact that the majority of both theoretical and empirical studies have produced controversial and ambiguous results according to the question of how income inequality affects growth, Dominicis, Florax and Groot (2008), try to tackle the controversy by using meta analysis to systematically describe, identify and analyze the variation in outcomes of empirical studies. With the use of meta analysis they try to provide an in depth quantitative review of the empirical literature as well as to summarize they empirical evidence. They find that studies based on cross country regressions typically report a negative and statistically significant relationship, while studies using panel estimation techniques find a positive and statistically significant relationship. Furthermore their results suggest that the statistically significant coefficient seems to disappear when the system GMM estimator is adopted. Their

findings show that it is misleading to simply speak of a positive or a negative relationship because it could be generated by the differences of the methods in uses.

3. Empirical Analysis

3.1 Methodology

Our empirical investigation of how income inequality affects economic growth will be based on panel data analysis on the regression that is represented by the following equation mention by Dominicis, Florax and Groot (2008):

$$(logy_{i,t} - logy_{i,t-1}) = \alpha_0\, y_{i,t-1} + \alpha_1\, g_{i,t-1} + X_{i,t-1}\beta + \varepsilon_{i,t} \qquad (1)$$

where $(logy_{i,t} - logy_{i,t-1})$ is the average GDP per capita growth rate of country i for the period t,

$y_{i,t-1}$ is the average initial GDP per capita of country i for the period t-1,

$g_{i,t-1}$ is the average EHII index (based upon the Theil index) of country i for the period t,-1

$X_{i,t-1}$ is a matrix of variables that includes a other factors that affect GDP per capita growth as suggested by Barro (1996). Such factors are the average population growth, average investment levels, average human capital, average terms of trade,

average inflation, average government consumption and democracy (note that the lagged forms of all of them are introduced on the equation),

and ε is the white noise error term.

In order for our model to robustly explain the relationship stated by equation (1) we have to also take into account possible structural differences between the countries of our sample. Those structural differences might be necessary if they are implied by the Hausman Test. So we need to take into account the fixed country effects for our sample, in order for our estimators to be unbiased. Thus, equation (1) is formulated to the following:

$$(logy_{i,t}\text{-}logy_{i,t-1}) = \alpha_0 y_{i,t-1} + \alpha_1 g_{i,t-1} + X_{i,t-1}\beta + u_i + \varepsilon_{i,t} \qquad (2)$$

where u_i represents the fixed country effects. A possible relationship which includes fixed effects might be a better specification of our model if the p-value of the F-test leads us to reject its null hypothesis that fixed effects are not important.

Many studies including, Forbes (2000) and Voitchovsky (2005) find a significant problem of omitted variable bias. That is because in the right hand side of equation (1) exists the initial GDP per capita variable which also formulates the dependent growth variable. So in order for our model to robustly explain the relationship explored we can also estimate the possible relationship with the Generalized Method of Moments (GMM), which is a dynamic panel estimation

method, if we have evidence that our model suffers from omitted variable bias.

The GMM estimator have been originally proposed by Arellano and Bond (1991). Their method estimates a dynamic model from our panel data as their GMM estimator exploits all the linear moment restrictions that follow from the assumption of no serial correlation in the error terms. Thus the estimated equation formulates to the following, by simply rearranging terms :

$$logy_{i,t} = \alpha_0 logy_{i,t-1} + \alpha_1 g_{i,t-1} + X_{i,t-1}\beta + u_i + \varepsilon_{i,t} \qquad (3)$$

Note that the coefficient α_0 has to be less that 1 in order for our model to explain the convergence hypothesis. An $\alpha_0 < 1$ is equivalent to a negative coefficient of initial GDP per capita for equations (2) and (3).

Furthermore, our model may suffer from endogeneity if income inequality is also determined by economic growth. A general method used in the literature in order to fix those endogeneity problems is to estimate the given model with instrumental variables regressions (IV) such us the two stages Least Squares estimation method. The vast majority of studies on the subject such as Li and Zou (1998) argue though that if the model uses 5 year averages and all the independent variables are in lagged form, the possible long term relationship we can estimate is practically not affected from the endogeneity issues that we have already mentioned. Despite that we try to investigate a possible relationship between income inequality and growth with IV regressions as well. We estimate the coefficients using the Two stages least squares estimators while instrumenting for

the inequality index. The instrumental variable though, has to both strongly correlate with the inequality index and not correlate with the residuals of our regression. So, it need to have a high value of correlation with the inequality index and zero covariance with the growth indicator, in order not to correlate with the residuals of our regression.

3.2 Data and Descriptive Statistics

3.2.1 Data

As we already mentioned in the econometric analysis all our variables indicate the five year averages of the original variables and from now on when we mention a variable it will represent the five year average of the variable. The dependent variable will be the GDP per capita growth rate and we represent it as "growth". Our independent variables are the EHII index as a measure of income inequality and other growth promoting factors such as the initial GDP per capita, investment ratio, population growth, human capital index, democracy index, government consumption, terms of trade and inflation rates. They are represented as "EHII", "rgdpo_percap", "investment", "popgrowth", "hc", "democracy", "csh_g", "tot" and "inflation respectively. Also the instrumental variable used in the Two stages least square regressions is the industrial pay inequality and it is represented as "IPI". In the GDP per capita case we assume that PPP holds (the relative prices are constant), because of the fact that as Piketty (2014) mentions the variance of prices

over time tend to interpret the results when it comes to the level of production in an economy.

Our data set is a panel of 126 countries for the timespan from 1968 to 2007. All our data represent the 8 five-year period averages for the previously mentioned timespan. We choose to exclude the five-year period from 2008 to 2012, from our data set due to the lack of data availability from 2010 to 2012. The five year averages is a common procedure followed in growth regressions as Barro (1996) mentions. Thus, our overall sample consists of 8 five-year period averages for the 126 countries. The periods are 1968- 1972, 1793-1977, 1978-1982, 1983-1987, 1988-1992, 1993-1997, 1998-2002 and 2003-2007. That should give us a total of 1008 observations, but due to the fact that our panel is quite unbalanced we do not reach that number of observations.

The 126 countries that our panel refers to are **:** Albania, Angola, Argentina, Australia, Austria, Azerbaijan, Bangladesh, Barbados, Belgium, Benin, Bolivia, Botswana, Brazil, Bulgaria, Burkina Faso, Burundi, Cameroon, Canada, Central African Republic, Chile, China, China (Hong Kong SAR), China (Macao SAR), Colombia, Congo, Costa Rica, Cote d'Ivoire, Croatia, Cyprus, Czech Republic, Denmark, Dominican Republic, Ecuador, Egypt, El Salvador, Estonia, Ethiopia, Fiji, Finland, France, Gabon, Gambia, Georgia, Germany, Ghana, Greece, Guatemala, Honduras, Hungary, Iceland, India, Indonesia, Iran (Islamic Republic of), Iraq, Ireland, Israel, Italy, Jamaica, Japan, Jordan, Kazakhstan, Kenya, Kuwait, Kyrgyzstan, Latvia, Lesotho, Liberia, Lithuania, Luxembourg, Madagascar, Malawi, Malaysia, Malta, Mauritius, Mexico, Mongolia, Morocco, Mozambique,

Nepal, Netherlands, New Zealand, Nigeria, Norway, Oman, Pakistan, Panama, Paraguay, Peru, Philippines, Poland, Portugal, Qatar, Republic of Korea, Republic of Moldova, Romania, Russian Federation, Rwanda, Senegal, Singapore, Slovakia, Slovenia, South Africa, Spain, Sri Lanka, Sudan, Suriname, Swaziland, Sweden, Switzerland, Syrian Arab Republic, Thailand, The f. Yugosl. Rep. of Macedonia, Togo, Trinidad and Tobago, Tunisia, Turkey, Uganda, Ukraine, United Kingdom, United Republic of Tanzania, United States of America, Uruguay, Venezuela, Yemen, Zambia and Zimbabwe.

The EHII, democracy and IPI observations are obtained by the University of Texas inequality project (UTIP). IPI is based on aggregate payrolls and social transfers don't enter into it at all while Estimated Household Income Inequality Data Set (EHII) is a global data set, derived from the econometric relationship between UTIP-UNIDO, other conditioning variables, and the World Bank's Deininger & Squire data set (source: http://utip.gov.utexas.edu/data.html) and it is based on the Theil index (the value of zero indicates perfectly equal distribution of income). The democracy indicator's maximum value is 1 and minimum value is 0. If it equals to 1 the the country is democratic for the given five year period and if it equals to 0 the political regime was either autocratic or a dictatorship. Values between zero and one indicate that the country was democratic but not for the total number of years included in the five year period.

The investment indicator used which is the Gross fixed capital formation (% of GDP) is obtain by the World Bank national accounts data, and OECD National Accounts data files. The gross capital formation includes land improvements

(fences, ditches, drains, and so on); plant, machinery, and equipment purchases; and the construction of roads, railways, and the like, including schools, offices, hospitals, private residential dwellings, and commercial and industrial buildings. (source: World Development Indicators).

All the other variables are obtained by the PWT 8.1 which is constructed by Feenstra, Robert C., Robert Inklaar and Marcel P. Timmer (2015). The “rgdpo” variable (which represents the GDP per capita variable but also is used to construct the growth variable) is the Output-sidereal GDP atchained PPPs(in mil. 2005US$). Popgrowth is constructed with the use of the “pop” variable of the data set which denotes the Population (in millions). “Hc” is the Index of human capital per person, based on years of schooling (Barro/Lee, 2012) and returns to education (Psacharopoulos, 1994), while “csh_g” is the share of government consumption at current PPPs. The terms of trade variable is calculated as the portion of the share of merchandise exports at current PPPs to the share of merchandise imports at current PPPs (csh_x and csh_m respectively). Last but not least the inflation ratio is generated by obtaining the growth rate of the price level of household consumption, price level of USA GDPo in 2005=1 (pl_c).

3.2.2 Descriptive Statistics

Before we go any further proceeding on the econometric analysis we need to analyze and describe our data, in order to have some basic early results. The results are subtracted using indicators the previously mentioned data. Table 1 reviews some basic summary statistics for our sample while Table 2 presents the mean, std.dev. and the number of observations of the growth rate and the EHII index for each one of the eight five-year periods. Graphs 1 and 2 present he evolution of the Growth rate and the EHII index respectively over time. Last Graph 3 is a scatter diagram which represent the correlation between the growth rates and the lagged value of EHII. Note that the X axis represents the label of the period with 1,2,3,4,5,6,7,8 denote 1968- 1972, 1793-1977, 1978-1982, 1983-1987, 1988-1992, 1993-1997, 1998-2002 and 2003-2007 respectively.

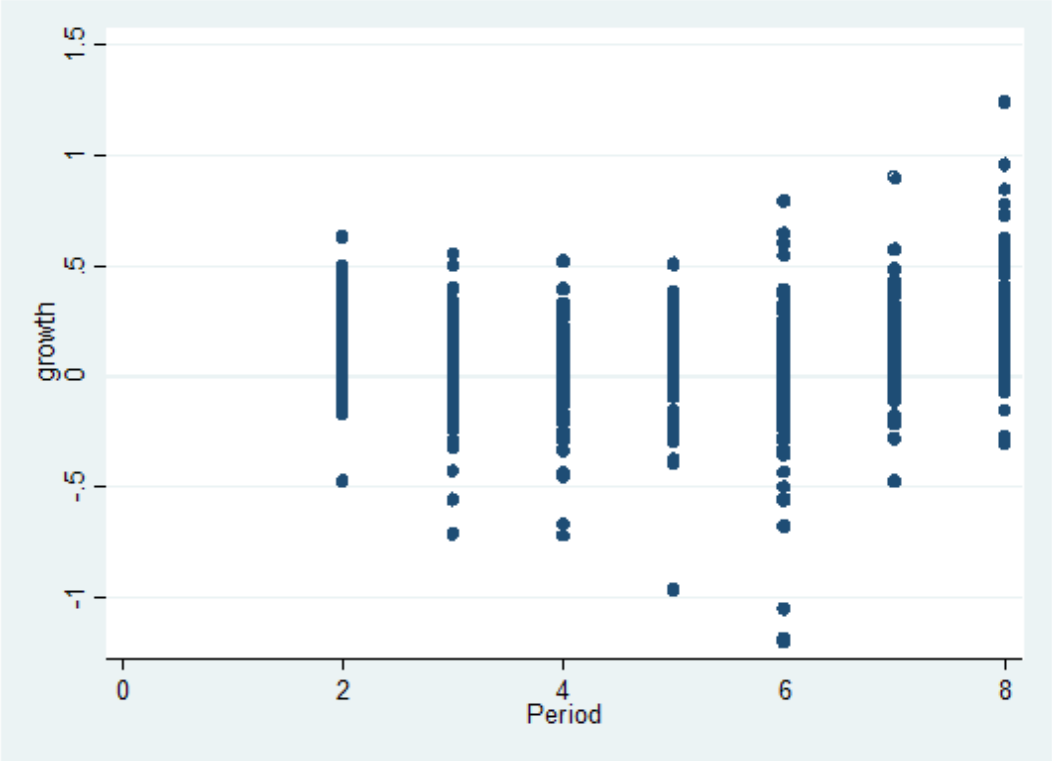
Table 1. Summary statistics for all the variables

Variables	obs	Median	Mean	Std.Dev.	Skewness	Kurtosis
Growth	818	0.11	0.09	0.22	-0.67	8.82
Real GDP per capita	944	8.52	8.51	1.19	-0.45	2.17
Human capital	876	2.19	2.2	0.6	0.24	2
Government consumption	944	0.18	0.2	0.98	1.87	8.63
EHII	750	43.55	42.32	7.24	-0.5	2.56
Investment	856	21.53	21.76	6.84	1.07	8.56
Democracy	922	0.6	0.52	0.48	-0.08	1.06
Terms of Trade	944	0.83	0.98	0.94	11.27	218.11
Population Growth	763	-2.32	-2.67	0.98	-1.88	8.45
Inflation	818	0.18	0.19	0.29	0.22	3.82

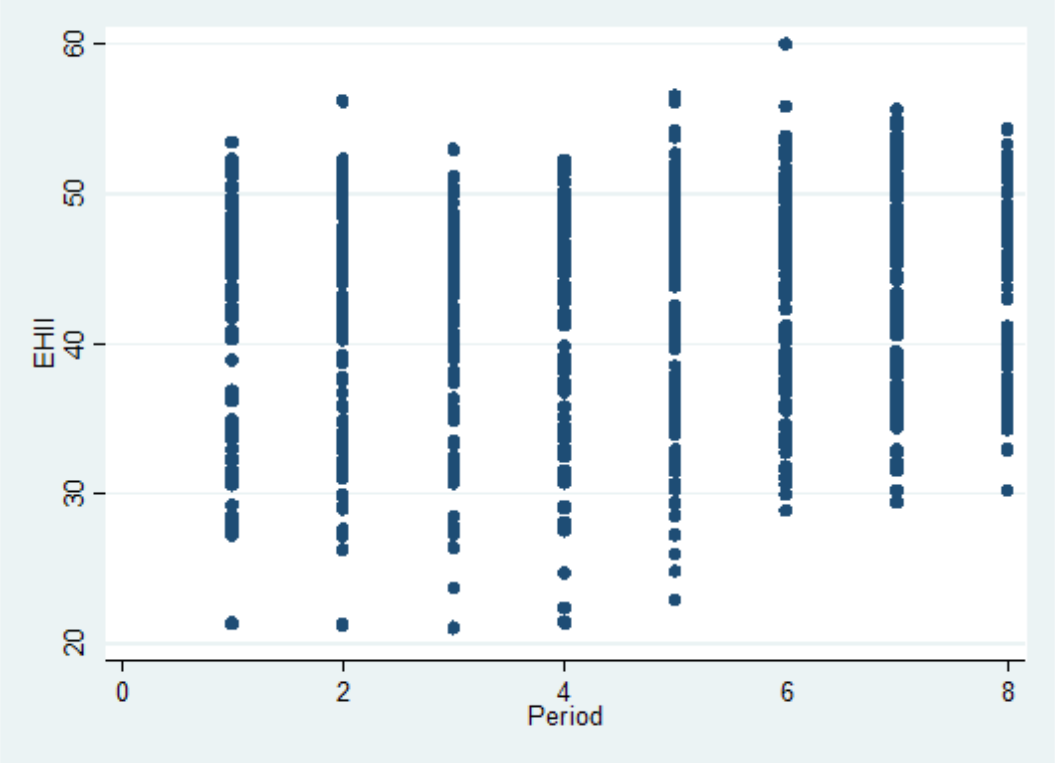
Table 2. Growth and EHII over time

Period	Variable	Mean	Std.Dev.	Obs
1968-1972	Growth	-	-	-
	EHII	42.32	7.46	84
1973-1977	Growth	0.15	0.16	110
	EHII	41.87	7.74	89
1978-1982	Growth	0.08	0.19	110
	EHII	41.07	7.3	94
1983-1987	Growth	0.03	0.18	110
	EHII	41.61	7.63	96
1988-1992	Growth	0.06	0.21	110
	EHII	42.01	8.04	100
1993-1997	Growth	0.02	0.29	126
	EHII	43.12	6.89	104
1998-2002	Growth	0.11	0.18	126
	EHII	43.69	6.51	103
2003-2007	Growth	0.2	0.23	126
	EHII	42.81	5.87	80

Graph 1. Growth rates over time



Graph 2. EHII over time



Graph 3. Growth versus lagged EHII

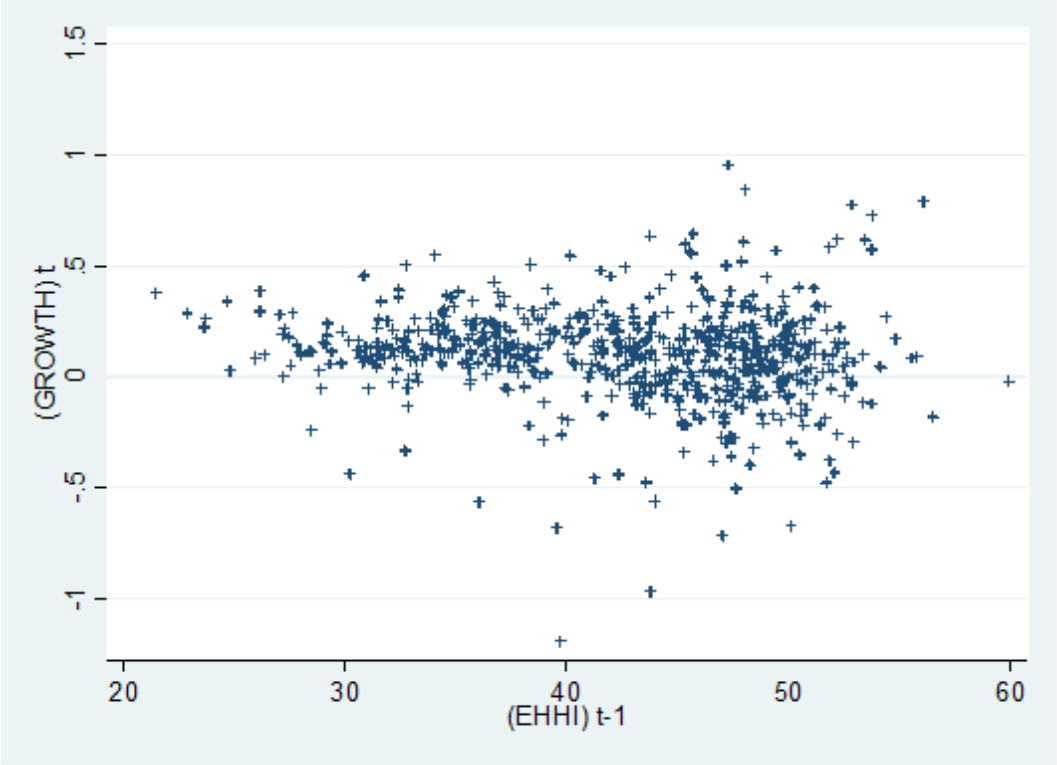


Table 1 summarizes some basic descriptive statistics for our sample, while Table 2 reviews the movement of the means and Standard Deviation of both the EHII inequality index and the growth rates, over time. It also presents the number of observations for both the inequality and the economic growth indexes for each of the eight five-year averaging periods.

Graph 1 shows the evolution of GDP per capita growth rates over time. We can see that the very beginning of our sample is characterized my the big recession of the '70s basically due to the fact of the great oil crisis of 1973. Also table 1 shows that our sample indicates a whole business cycle, with recession depression, recovery and expansion did all happen in the period of our sample (1968-2007). Furthermore Table 2 presents the evolution of the inequality index over time. As we can see the argument that inequality is rising shakes down. There is no evidence that inequality has risen over the years. Despite being volatile the EHII index seems to be in the same levels from period 1968-1972 to 2003-2007.

Lastly, Graph 3 is a scatter diagram between the growth rates and the lagged value of income inequality. There does not seem to exist a relationship between income inequality and the growth rate levels of the next period. Despite that, this conclusion could be naive because of the fact that it is derived by the descriptive statistics and not by econometric analysis. Thus, in the next section we present the results of our econometric analysis derived by using the methodology analyzed in the section 3.1.

3.3 Results

Tables 3,4,5,6,7 summarize the results of our empirical investigation. Note that in all our tables *, ** and *** denote significance in 1%, 5% and 10% respectively. Furthermore all our regressions' results are corrected for heteroscedacity. Because of the fact that we test for heteroscedasticity and find a significant problem, all are regressions denote the results with robust standard errors.

At first table 3 presents a standard growth regression which is represented by equation (1), with the EHII index excluded. Collumn 1 indicates the OLS estimators while collumn 2,3 and 4 indicate the “fixed effects”, “random effects” and “fixed country and fixed year effects” estimators respectively. The value of hausman test indicates that fixed effects estimation is a better specification than random effects. The Breuch Pagan Lagrange Multiplier test indicates that the OLS estimators are also better a specification than random effect, while the value of the Parm test denotes that our model can be specified better if we not only introduce fixed country effect but also fixed year effects. Thus the “fixed effects” and “fixed country and year effects” specifications seem to be more accurate.

Tables 4,5,6 and 7 present the results of our investigation according to the influence of income inequality on growth. Table 4 presents our results with OLS estimators of equation (1) while tables 5 and 7 present our results using fixed effects and Two stages least squares estimators respectively. In the Two stages least squares regressions, the instrument used is the lagged value of the industrial pay inequality (IPI) because of the fact that it is both strongly correlated with the

lagged value of the EHII index (cor($EHII_{t-1}$,IPI_{t-1})=0.66) and we assume that they do not correlate w with the residuals of the regression (cov(growth,IPI_{t-1})=0.006). Also note that in the Two stages least squares case we also take into account possible fixed country effects. Lastly table 6 presents the results using Generalized method of moments (GMM) estimators. The results are obtained estimating equation (3).

The hausman test indicated that the fixed effects specification is preferable to a possible random effects model. Also the value of the Ramsey Reset test, indicated that the results obtained by OLS regressions can be biased due to the GDP per capita variable being omitted. In order to account for that the GMM specification is used. Lastly, the Two Stages Least Squares specification has to be taken into account in order to correct possible endogeneity of income inequality in our model.

As we can see from table 3, the main determinants of GDP per capita growth appear quite normal according to what is predicted by Barro (2000). Higher investment levels and human capital stock levels tend to generate greater growth rates. Inflation has definitely a negative impact on growth, while the negative coefficient of the initial GDP per capita confirms the convergence hypothesis. Also, as we already mentioned the fixed country and year effects regression (FCY) and the fixed effects regression (FE) are the best specifications of our model according to the testing procedure mentioned.

Table 3. Growth regression

Independent Variable	OLS (1)	FE (2)	RE (3)	FCY (4)
pop growth$_{-1}$	-0.009	-0.020	-0.010	-0.013
investment$_{t-1}$	0.005***	0.003	0.004***	0.003*
hc$_{t-1}$	0.280	0.27***	0.064*	0.002
rgdpo_percap$_{t-1}$	-0.003	-0.322***	-0.025	-0.35***
csh_g$_{t-1}$	-0.080	-0.099	-0.060	0.040
inflation$_{t-1}$	-0.135***	-0.12***	-0.11***	-0.087***
democracy$_{t-1}$	0.003	-0.002	0.005	-0.040
tot$_{t-1}$	-0.018	-0.030	0.015	0.001
constant	-0.080	1.84***	0.100	2.89***
prob>F (on (3) prob>x^2)	0	0	0	0
# of observations	562	562	562	562
R^2	0.1	0.22	0.09	0.49

Table 4. OLS

Independent Variable	OLS (1)	OLS (2)	OLS (3)	OLS (4)
$EHII_{t-1}$	-0.027	-0.0008	-0.0035	-0.0019
pop $growth_{t-1}$	-0.039	-0.098	-0.002	-0.0096
$investment_{t-1}$	0.005***	0.005***		
hc_{t-1}	0.018		0.027	
$rgdpo\_percap_{t-1}$	-0.028	-0.0145	-0.0017	0.0175
csh_g_{t-1}	-0.042	-0.0871	-0.059	-0.0891
$inflation_{t-1}$	-0.171***	-0.166***	-0.149***	-0.149***
$democracy_{t-1}$	0.0064	-0.0003	0.011	0.005
tot_{t-1}	-0.0234	-0.0301	-0.023	-0.030
constant	0.139	-0.0529	0.254	0.0717
prob>F	0	0	0	0
# of observations	476	501	505	526
R^2	0.11	0.1041	0.098	0.0904

Table 5. Fixed Effects

Independent Variable	FE (1)	FE (2)	FE (3)	FE (4)
$EHII_{t-1}$	-0.0318	0.0087**	0.0028	0.0087*
pop $growth_{t-1}$	-0.120	-0.0324*	-0.027	-0.042**
$investment_{t-1}$	0.0018	0.002		
hc_{t-1}	0.239***		0.1921***	
$rgdpo\_percap_{t-1}$	-0.348***	-0.297***	-0.319***	-0.262***
csh_g_{t-1}	-0.081	-0.207	-0.115	-0.197
$inflation_{t-1}$	-0.1488***	-0.1861***	-0.136***	-0.15***
$democracy_{t-1}$	0.0359	-0.0028	-0.021	0.0045
tot_{t-1}	-0.0015	-0.009	-0.0038	-0.016
constant	2.785***	2.18***	2.16***	1.88***
prob>F	0	0	0	0
# of observations	476	501	499	526
R^2	0.488	0.4895	0.455	0.452

Table 6. GMM (Dependent variable is the Initial GDP per capita of period t)

Independent Variable	FE (1)	FE (2)	FE (4)
$EHII_{t-1}$	0.0101*	0.011*	0.0105
pop $growth_{t-1}$	0.0072	0.010	-0.016
$investment_{t-1}$	-0.00004	-0.00070	
hc_{t-1}	0.2336*	0.268**	
$rgdpo\_percap_{t-1}$	-0.568***	-0.571***	0.692***
csh_g_{t-1}	-0.360		-0.585***
$inflation_{t-1}$	-0.061*	-0.589*	-0.081**
$democracy_{t-1}$	0.0175		0.054*
tot_{t-1}	-0.009		-0.012
constant	2.961***	2.88***	2.26***
prob>x^2	0	0	0
# of observations	476	478	526
# of instruments	35	32	33

Table 7. Two stages least squares

Independent Variable	2SLS (1)	2SLS&FE (2)	2SLS&FE (3)	2SLS&FE (4)
$EHII_{t-1}$	0.0068	0.010	0.010	0.023***
pop $growth_{t-1}$	-0.0022	-0.0014	-0.022	-0.04***
$investment_{t-1}$	0.0059***	0.0013	0.0011	
hc_{t-1}	0.034	0.214***	0.189***	
$rgdpo\_percap_{t-1}$	0.021	-0.337***	-0.331***	-0.259***
csh_g_{t-1}	-0.061	-0.093	-0.042	-0,182
$inflation_{t-1}$	-0.147***	-0.144***	-0.141***	-0.13***
$democracy_{t-1}$	-0.0079	-0.049		-0.017
tot_{t-1}	0.032	-0.0089		-0.024
constant	-0.572	1.86***	1.87***	1.378***
prob>x^2	0	0	0	0
# of observations	469	469	471	518
R^2	0.055	0.485	0.482	0.433

Table 4 illustrates the results of estimating the possible relationship with OLS estimators. The indicator of income inequality seems to have no impact on growth. The only regression in which it is statistically significant is the one with the investment levels absent. The main determinants of economic growth seem to be the investment levels (positive effect) and the inflation rate (negative effect) . The value of the F-test equating to zero (The null hypothesis is that all of the fixed effect intercepts are zero) indicate that fixed effects have to be introduced in our model, as a better specification.

Table 5 presents our findings using fixed effects in our model. The coefficient of EHII is positive and statistically significant in two of our four regressions. Also population growth, inflation and initial GDP per capita seem to have a negative impact on growth, while the human capital levels seem to enforce growth. All the results appear to be as expected from the literature, except from the non significance of the investment levels. Performing a Ramsey Reset test we suspect that our model may suffer from omitted variable bias and so a GMM spesification would provide us better unbiased results.

The results of table 6 are extracted while estimating equation (3). The dependent variable is the GDP per capita in period t while all the other variables are lagged. The coefficient of Income inequality is positive and statistically significant on 3 of our 4 regressions which means that greater income inequality could actually lead to an increase of GDP per capita in the next period. Also while greater values of both human capital and democracy tend to increase the GDP per capita of the next period, greater values of the inflation rate and government consumption of the previous period tend to have a negative impact. Note that the convergence

hypothesis is verified with the absolute value of the coefficient of GDP per capita$_{t-1}$ being less than 1 (the differential equation converges).Despite the provision of better results in terms of robustness, the non significance of the investment levels seems alarming. As we already mentioned, because of the fact that our results might be omitted due to the possible endogeneity of income inequality, we proceed in estimating a possible relationship with the Two Stages Least Squares method, while instrumenting for the EHII index and using IPI as an istrument. The results obtained using the Two Stages Least Squares estimation method are presented in table 7. The impact on income inequality on growth is positive and statistically significant for all of our four regressions. Also population growth and initial GDP per capita tend to have a negative impact on growth while higher investment and human capital levels have a positive effect. Performing the Wooldridge's score test we accept the null hypothesis that all our variables are now exogenous (p-value = 0.22). Also performing the regression based Wooldridge test we tend to verify the exogeneity of our variables (p-value = 0.2396).

Overall, our results can be summarized as it follows: Firstly we verify the existing growth literature as it is illustrated by Barro (1996). We find that the main determinants of economic growth are the investment levels, the human capital levels, the population growth, the government consumption, the initial GDP per capita and the inflation rate. While higher investment and human capital levels can be thought as growth promoting factors greater values of population growth, inflation rate initial GDP per capita and government consumption can reduce the growth rates in an economy.

Secondly we find evidence that income inequality has a significant positive

effect on economic growth. Thus countries with higher income inequality will tend to have greater growth rates on the next period. An interpretation of those results could be that because of the greater income inequality, there are being created greater incentives to invest on both human and physical capital and so greater economic growth rates are being generated in the future. Our results are in line with the results of Li and Zou (1998), Forbes (2000), who also predict a positive impact on income inequality in growth.

Li and Zou (1998) by dividing government spending into production services and consumption services, which enter the production function respectively, predict that a positive association between income inequality and economic growth is ought to be expected. That occurs because while public consumption enters the utility function agents may favor greater levels of income inequality, in order to spend more and redistribute less. So the low levels of taxation chosen by the government favors economic performance while income inequality may rise due to the poor redistribution policies.

Furthermore Saint-Paul and Verdier (1993) also enhances our argument. In an economy characterized by more unequal distribution of income the economy may be leaded to greater economic growth rates, even with high levels of taxation. In this framework, the median voter because of the greater income inequality might prefer greater levels of taxation in order to finance public education. The better financed public education can lead to greater stocks of human capital in the future and so, greater economic growth.

Summarizing, a more unequal economy may achieve greater economic growth rates. So a policy maker faces a certain dilemma, due to the trade off between

decreasing income inequality and increasing economic growth, in order to maximize the welfare of an economy. Our results are supported also theoretically by Li Zou (1998) and Saint-Paul and Verdier (1993). A more unequal in terms of income economy may achieve greater economic growth rate rates. That occurs because the greater income inequality either favors lower taxation in order to consume more and so enhance growth via the lower taxation channel, or it favors higher taxation in order to enhance the public education sector, and so may enforce economic growth via the human capital channel.

As we already mentioned those results have certain policy making implications. A policy maker has to take into account that positive relationship in order to enhance the welfare of an economy. That is because targeting the rapid decline of income inequality may lead to a decrease of the income itself. In other words the purpose of a better distribution of the pie may lead to the decrease of the pie itself. Thus, the proper policies are implied only if in terms of welfare, the marginal benefit due to the lower income inequality exceeds the marginal cost due to the lower growth rates.

4. Concluding Remarks

Our empirical investigation can be thought as a small yet significant contribution to the extended literature on the subject. Using panel data analysis estimation techniques such as fixed effects, GMM and Two stages Least squares, we report a significant positive relationship between income inequality and growth. Our hypothesis indicates that the channels through which that exact relationship occurs are the human capital and taxation. At first, agents may favor lower taxation in order to consume more and redistribute less. The lower levels of taxation can enhance economic growth, while also increase income inequality. Secondly, that relationship can operate even if agents favor a higher tax rate. High levels of income inequality can lead the median voter to choose high levels of taxation in order reduce income inequality. This can lead an economy to a state of better financed public education and so to a greater human capital stock which can drive the economy to operate more efficiently.

We made use of the Two stages Least squares estimation technique in order to make sure that our results are not affected even if income inequality is endogenous to our model. The vast majority of the literature on the subject, propose that endogeneity can be thought as a non issue. As Li and Zou (1998) mention, due to the fact that all the right hand side variables are lagged for a five year period, endogeneity cannot cause serious estimation problems. Despite that wanting to be sure that possible endogeneity does not driving our results we control for the possible inverse causal relationship using the Two Stages Least Squares method. The instrument used is the wage inequality on the industrial sector. The imposition

of an instrumental variables method though does not affect our results with income inequality having a positive impact on growth, while the main determinants of economic growth such as investment, human capital, initial GDP per capita and inflation have the expected by Barro(1996) effect (positive, positive, negative and negative respectively).

Concluding we want to propose possible further exploration guidelines about some key parameters of the matter. In our opinion, future research has to focus on the channels through which income inequality affects economic growth. It is critical to examine how those channels exactly work in order to gain a better understanding according to one of the most key answers of political economy: How an economy can raise its wealth and how this wealth has to be distributed. It is possible that that the exploration of how the mentioned channels work can be made more efficiently. Working with micro data in order to determine exactly which agents' decisions can lead a possible relationship to work that way.

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