Department of Economics and Finance

Chair of Macroeconomics

IS EQUALITY GOOD OR BAD FOR GROWTH?

AN EMPIRICAL ASSESSMENT

SUPERVISOR

Prof. Giovanna Vallanti

CANDIDATE

Daniela Marangio

ID Number: 164991

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To my parents and my sister

Abstract

This paper reconciles the controversial findings about the relationship between income inequality and economic growth by proposing a different approach for the analysis of the problem. While former studies tried to assess if this relationship was strictly positive or negative, this paper finds a not univocal effect of income inequality on growth, demonstrating empirically an inverted "U" shaped relationship between these two variables. It is proved that inequality is neither beneficial nor harmful in absolute terms, but its effect varies according to its level: low level of income inequality are positively correlated with growth, while high levels turn to be harmful for a country development, inverting the sign of the relationship. This is due to a trade-off between the economic enhancing effects of more equality and the distortionary effects of high taxation. Indeed more equality is beneficial since it brings as its main effects: higher human capital accumulation, wider domestic demand and lower capital dilution due to lower fertility rate. Instead, a too strong redistributive policy through high taxation is growth detrimental since it prevents investments and it lowers the marginal return on merit. An econometric study with panel data estimations on 90 countries in the period 1968-2002, confirms the theory and finds an optimal level of inequality, which maximizes the potential growth of a country. It is proved empirically that this point is unique and it does not vary with respect to the stage of development of a given country.

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1.Introduction

From the second half of the 20th century, a lot of attention has been given to the links between income distribution and economic growth. The way of analysing this relationship has changed over time. Before 1980s the majority of the studies focused on the effects of economic growth on the distribution of income. Only afterwards, the reverse causation between income inequality and potential growth have been analysed, considering the level of inequality as a variable determinant for the potential growth of an economy.

In the late nineteenth-century, when the first relationship between growth and inequality was studied, Pareto believed firmly in the "iron low of interpersonal inequality" (Branko Milanovich, 2011). He believed that inequality was constant over time and it was not affected by the process of development. He argued that although a change in the structure of society, could lead to a change in the distribution of powers, this would not affect the distribution of income, which remained constant.

Only in 1955, a Russian-American economist and statistician, Simon Kuznets theorized the first model about the effects of economic growth on income distribution. He found an inverted U-relationship between growth and inequality, during the process of industrialization of countries. According to this theory, in the early stage of development the shift from the rural to industrialized economy, leads to an increase in inequality. This is due to the migration of a large size of population from the countryside to cities, where more differentiation of wages takes place. However, when a certain level of GDP is reached, the process of democratization starts, the education system develops together with a rise of welfare state, leading to more redistribution policies and lower inequality.

Kuznets' theory is considered explicative for the description of the relationship between growth and inequality for developing economies. What instead is still not clear and open to discussion is the effect that inequality and redistribution policies have on a country's potential economic growth. This approach was never developed before 1980s. Only in those years, endogenous growth models started integrating income inequality, among the factors that affect growth (Stern, 1991). All these models have found

controversial results, which cannot be summarized easily and will be discussed later in the literature.

One of the most famous paper on this topic is that by Bénabou (1996). He studied the effects of inequality on a country development, starting from the analysis of the economic divergence between Philippines and Korea, firstly discussed by Lucas (1993). These two countries in the early 1960s were similar with respect to many macroeconomic variables: GDP per capita, population, level of education, urbanization. However, while Korea experienced a huge growth for several years of 6% annum, Philippines stagnated at 2%. This difference was justified at least partially by Bénabou by the fact that Philippines had a much more unequal distribution of income than Korea.

However, the negative relation assessed by Bénabou is even now under discussion, leaving the matter open to objections. Indeed, the new dominant vision is that, income inequality, affects the potential growth of a country either negatively or positively, through various transmission channels.

The main purpose of this paper is to review the literature regarding the problem and to propose a new approach in analysing the relationship between income inequality and growth. This paper is organized as follows: section 2 presents a short analysis of the variable "inequality", with a small review of the main methods of measurement; section 3 summarizes the main factors that affect growth; section 4 reports the main channels of transmission through which inequality affects economic growth; section 5 suggests a new approach to the problem, introducing the concept of ORI (Optimal Rate of Inequality) mentioned for the first time by Jeorge Charles-Coll (2012); section 6 reports the empirical econometric results; finally, section 7 concludes the study.

2. Inequality: definition and main methods of measurement

2.1 Definition

The concept of economic inequality can be described as the disparity between the percentage of population and the percentage of resources possessed by the latter. It is usually calculated with respect to income and it is maximum in case all the resources are owned by a single individual, while it is zero when each person possesses exactly the same amount. Moreover, it is important to distinguish among three types of inequality: inequality among individuals within a single community, usually a nation; inequality in income among countries or nations , and global inequality or inequality among all citizens of the world. This paper will focus on the first type.

2.2 History of inequality measurement.

In history the measurement of inequality has not always been defined in the same way. Until the first year of twentieth century inequality was measured as the distribution of national income between large social groups. Society was split into three distinct social classes: workers, who generally had a low income level; capitalists, who invested in capital and earned profit and landlords, who owned lands and gained rents from their use. In those years David Ricardo, Karl Marx and other economists, using this functional distribution of national income, started predicting which negative effect such unequal distribution could have had on investments and growth (Branko Milanovich, 2011).

This way of analysing income distribution did not change until the early 1900s, when Vilfredo Pareto, a Franco-Italian economist, started looking at the problem considering distribution of income among individuals rather than among social classes. In those years economic development and a broader fiscal role of the state leaded to the collection of the early statistics on income distribution.

Nowadays the majority of the statistics are based on households. Each household is considered as an "income" or "consumption" unit and all members are considered sharing equally total income or consumption. However these two variables are not equivalent for the calculation of distribution inequality. Indeed inequality is usually higher when calculated using income statistics, than when computed with consumption

figures. There are two main reason for this. First, it is impossible for a person to consume zero while it is possible to have zero income. This can happen thanks to the existence of financial markets and the possibility of accumulated savings. Second, rich people are supposed not to spend all their income, but to save and invest a proportion of their earnings. Therefore income is much more unequally distributed than consumption (Branko Milanovich, 2011).

2.2.1. Properties of indexes

In history, economists have tried to develop inequality statistics that were able to describe such a complex reality in a single number. This became fundamental when inequality was integrated as a variable in endogenous growth models for econometric analysis. Different measurements have been built and several axioms were defined to reach meaningful indexes.

The most important, that are worth to mention are:

- **The Pigou-Dalton principle (principle of the transfer):** if a transfer of income from a rich individual to a poor one occurs and nothing else changes, the measure of inequality should fall;

- **Anonymity Principle or Symmetry**: the identity of individuals should be irrelevant so that if two people exchange their income the result in the calculation is unaffected;

- **Mean Independence**: if all incomes are multiplied by a constant the inequality measure doesn't change;

- **Sample independence:** if each income is multiplied m times, the inequality of the new sample is exactly the same of the previous one.

All the statistics that satisfy these properties are part of the "Generalised Entropy Inequality Measures" (Cowell,1995).

2.2.2 The main measurements

Several measurements have been used to describe inequality but those that better fit the axioms before mentioned and therefore the most used are the Percentile Ratio and the Gini Index, which is calculated starting from the computation of the Lorenz curve.

The Percentile Ratio

To calculate these statistics, the population is divided in percentiles according to the level of per capita income. Therefore, ratios of the mean value of different percentiles are calculated, otherwise the average value of the highest percentile is compared to that of the lowest.

A number of percentiles and their ratios have been used to study changes in household income. The most used ratios are those comparing the income of the 90th percentile to that of the 10th percentile (90/10) or the 90th percentile to the median (90/50). It is a measure easy to calculate and it is straightforward to understand, however it does not satisfy the Pigou- Dalton Principle.

The Gini Index

The most used measure since 1947 has been the Gini Index. Indeed by providing a single statistics that summarizes the property of a given income distribution, it is very useful either as a focus on research or as a variable in statistical models.

First, the share of total income in a country earned by the poorest 1% of the population is calculated, than these computations are done for the 2% poorest share of population and so on. By associating these values the Lorenz curve is drawn. The more bowed out is the Lorenz curve the more unequally income is distributed. The Gini Index is calculated as the share of area between the line of perfect equality, that is represented by the 45° line and the Lorenz curve. This index ranges between zero and one; it is zero when the two lines coincide, which means that income is perfectly distributed among the entire population, while it is one when a single person owns the entire aggregate income and the rest earns nothing.
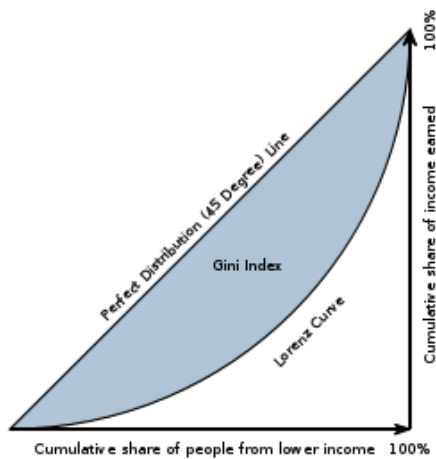
The Gini Index can be calculated mathematically with the formula:

$$\text{Gini} = \frac{2}{\mu n^2} \sum_{i=1}^{n} iX_i - \frac{n+1}{n}$$

where μ is the population mean, n is the weighted number of observations and X_i is the weighted income of individual i's rank in the income distribution

For the purpose of this study we will use the Gini Index, since it is the most used and the easiest to compute, but we will figure out if different outcomes will result using different measurements.

3.Factors that affect growth

According to the neoclassical theory, the level of output in a given country is influenced by those factors that affect the supply side of the economy. In the model of Solow-Swan the factors that figure in the production function and that affect the level of GDP are Human Capital, Physical Capital, Productivity and Technology. On the other hand, according to a Keynesian view, the potential future supply is driven also by the expected domestic demand. Therefore, the size of domestic market, is also significant for the assessment of the potential long-run growth of an economy.

Human capital is the level of education and knowledge of the labour force. It is a fundamental input, especially for production of high technological goods in already developed countries. Human capital has the peculiar characteristic of decreasing marginal return, therefore its maximum level is achieved when it is distributed evenly among a large number of individuals.

Physical capital includes all the assets, plants, equipment and resources that are necessary for the production process. It shows constant marginal return and it is a very important input of production, especially for those economies that are at the first stage of industrialization.

Productivity is the effectiveness with which all inputs included in production are converted into output. It is a very important parameter in the production function. Indeed a country that has lower endowments of either physical or human capital, can still produce the same output per worker of a richer country, if its productivity level is higher. Moreover, this parameter is also associated with technological progress. Both productivity and technology have been the main drivers of economic development from the industrial revolution till now.

As already mentioned before, the size of the domestic market is also important for economic development. This idea was firstly introduced by the "balanced growth" approach (Nurske, 1968; Rosenstein Rodan, 1943), that emphasized the importance of local demand in triggering the process of development, especially for the underdeveloped countries.

These are the main factors that trigger the process of growth, but there are other fundamentals, that, although not figuring inside the theoretical production function before mentioned, are important to explain the process of growth. The government, with its political view and its intervention in the economy through fiscal policy, has a prominent role in a country economic growth. Other important factors are culture and the openness of a country to new ideas, citizens' propensity to save and their willingness to work hard. Moreover the geographical position and the resources embedded in a given area are also important to explain why some countries developed and others did not in history.

Another fundamental in assessing the potential growth of a country is the distribution of income and its level of inequality. This paper will analyse the effect of this variable on the process of a county economic development.

4.Theoretical effects of inequality on growth rate.

The factors that affect growth, seem to be distinct between themselves, but actually they are strictly interconnected through several mechanisms. Inequality itself influences a country growth, through different channels, which can be distinguished between pure economic and political economic. In the first category there are the effects of income inequality on the accumulation of both Physical and Human Capital, on the incentive to invest in innovation and on the size of domestic demand. The effects of inequality on physical and human capital accumulation will be discussed starting from the fertility approach and the imperfect capital market approach. The second category of political channels is instead divided into two subgroups: the effects on redistribution policies and efficiency and the effects on political instability.

4.1. The effect of inequality on physical capital accumulation

The Classical approach regarding the role of income distribution on the process of growth was first studied by Adam Smith in 1776 and then interpreted and developed by Keynes (1920), Lewis (1954), Kaldor (1957) and Bourguignon (1981). According to this theories savings rates are an increasing function of wealth and inequality, that therefore allows to channel resources towards those that have an higher propensity to save. This approach was also modelled by the Nobel prize Robert Solow in 1924. In his exogenous model of growth, capital is a fundamental input in the production function. Indeed, according to this model the level of GDP per capita is a function of the level of capital per capita.

He used a simple Cobb-Douglas production function:

$$F(K,L) = AK^{\alpha} L^{1-\alpha}$$

Where the parameter A measures the productivity for given quantities of aggregate capital K and labour L, while α ,that stands between 0 and 1, describes the share of quantity K and L necessary to produce a given unit of output Y.

By dividing the aggregate output level by the labour size and assuming full employment, we get that the output per capita is proportional to capital per capita and productivity

$$y = \frac{Y}{L} = \frac{F(K,L)}{L} = A \left(\frac{K}{L}\right)^{\alpha} \left(\frac{L}{L}\right)^{1-\alpha} = Ak^{\alpha}$$

Capital accumulation comes from savings, so it is straightforward that a country with an higher saving rate, eliminating the possibility of borrowing from abroad, will have a higher steady state of income per capita. Hence, according to this model an increase in the saving rate will result in a higher steady state and so in a period of transitional growth.

Inequality is related to the saving rate, since the higher a person's income the higher his saving rate is likely to be. The more unequal is the distribution of income, the higher the fraction of total income earned by rich people and so higher will be aggregate savings and investments. This consideration, together with the fact that capital accumulation shows constant marginal return, have been two points in favour of inequality to boost economic growth. This was considered especially true for those economies that are at the first stage of development and that are kept in poverty traps. Many different models, starting from that of Kuznet (1955), followed by Galor and Tsiddon (1997) Galor and Moav (1999), have suggest that income inequality affects economic growth positively in the first stage of development, to turn therefore negatively in the last stages. Indeed, for developed economies inequality turns to have worse effects for capital accumulation. This negative effects are more significant in case of imperfect capital markets.

4.1.2. Physical capital accumulation with imperfect capital markets

Capital market imperfection occurs whenever at a given interest rate level a phenomenon of credit rationing occurs. This event is due, according to economic theory, to two phenomena: adverse selection and moral hazard. The first one is attributable to the problem of asymmetric information and therefore to the inability of the lender in assessing the solvability of the borrower. The larger the amount borrowed the more probable is for the borrower not to pay back the loan. This is why in an unequal society this phenomenon is more relevant. Credit rationing is also linked to the problem of moral hazard, that instead concerns the risk the borrower will invest in very risky projects whenever obtained the loan. This risk is higher the greater is the amount

borrowed. This is due to the fact that in case of project failure the borrower will have little to lose.

These two phenomena are the main causes of credit rationing. Therefore, according to Piketty (1994), initial wealth will determine an household's ability to borrow, therefore his/her investment opportunities in either physical or human capital.

In his model Piketty (1994), assumes all individuals to be identical except for their initial wealth level, which is taken as a collateral from the financial markets. Therefore, only those with enough personal wealth will be able to finance themselves and undertake big investments. In his model, this effect is also strengthen by the existence of investment indivisibilities, which mean that each project entails a fixed minimum size. According to Ehrhart (2009) this has two effects: the initial wealth distribution determines (1) the future growth of an economy and (2) the level of wages and interest rate. Assuming credit rationing, indivisibility of investments and imperfect capital markets, an unequal distribution of wealth will perpetuate a process of low growth, potentially leading to "poverty traps", in which no social mobility will occur (Piketty, 1994).

The second main effect of this model is on the level of wages and interest rate. In a Solow- type model, without the problem of credit rationing, the equilibrium interest rate is determined by the marginal return on capital, regardless of the initial level of inequality. Indeed, there would be full ability to borrow and an optimal investment equilibrium where all individuals borrow at an interest rate given by the marginal return to capital. (Piketty, 1997a). However in the presence of credit rationing, especially in a very unequal society the demand for credit would be higher than the supply. Therefore, according to Piketty (1997a), the interest rate, driven by the equilibrium of supply and demand for credit, will be high in a unequal society and low in a more equal one. This has a self-fulfilling effect since higher interest rates and lower credit will increase poverty and reduce the possibility of social mobility. Conversely in a more equal society, lower interest rates, hence higher credit leads to more investment opportunities, higher growth and social mobility in the long run.

The same reasoning underlying the model of Piketty was presented by Banerjee and Newman (1993) in their dynamic model of capital accumulation with endogenous wage

rate. While in Piketty all individuals are considered as potential entrepreneurs that only differ in their initial wealth level, in Banerjee and Newman (1993) each household can decide over three different kind of occupation according to his/her wealth level: wage earner, who does not invest at all; self-employed, who undertakes medium size investment and employer, who invests large amounts of money. In an economy with capital market imperfections, the poorest households will become wage earner, middle income agents will choose to be self-employed and the richest will become employers. According to the classical theory, the equilibrium wage level for each of the three occupations will be determined by the level of demand and supply of labour. Therefore, an unequal society with a large mass of wage earners and a small number of employers, will have in equilibrium low wages, low capital accumulation for the poor and low upward mobility. This process according to this model will strengthen over time, therefore increasing inequality in the long run and reducing potential growth. Conversely, in a more equal society with a large number of potential employers and a relative low level of poor wage earners, equilibrium wage rate will be high with more possibility to accumulate capital even by poor people, leading finally to high social mobility.

These models go in the opposite direction with respect to the neoclassical theory regarding capital accumulation. But the fulcrum of the matter is that, while in the early stage of development it is important the role of an elite to boost the economy out of poverty and fertility traps, in already developed economies more participation in savings and investment activities is a desirable condition to keep growing. Furthermore, differently from the classical simple Solow model in the models of Piketty (1994) Banerjee and Newman (1993) productive technology exhibits even for physical capital, a decrease marginal return with respect to individual investments. The production function is therefore concave.

To summarize, for a developed economy redistribution of wealth is seen to have an overall positive effect on growth, even though inequality with respect to physical capital accumulation is controversial for the reason explained above. This ambiguity will disappear in the relationship between inequality and human capital accumulation.

4.2. The effect of inequality on the accumulation of human capital

Economists use to define with the term Human capital, all the improvements in the "quality" of labour force. This "quality" can be driven by several factors, but the most important are health and education. Several studies have assessed a negative relationship between life expectancy and inequality. Indeed, a very unequal distribution of resources leads often to malnutrition, lack of health assistance etc. However, the effect of human capital accumulation due to low population health is more relevant for developing countries than for already developed economies. For the latter, education and in particular the number of years of schooling are the main determinants of human capital accumulation.

Education is considered by economists as a form of investment. Indeed, it includes many different expenses, from those strictly related to the cost of accessing education, to those economic costs determined by the opportunity cost of not working. Therefore as for the investment decisions in physical capital, even for human capital the initial wealth level has a significant role. Under this scenario an imperfect capital market theory explains why in more unequal societies there is a tendency toward lower level of human capital accumulation. This effect is even strengthen if we take in consideration that in more unequal societies fertility rate and demographic growth result in the problem of capital dilution.

The paper of Galor and Zang (1997) analyses the interactions between the fertility rate, income distribution and education under imperfect capital markets. Under this study a greater fertility means fewer financial resources available in a given family. Moreover, given the credit constraint due to capital market imperfections, having more children for each family means a lower enrolment rate for the overall society. This effect is strengthen the more unequal society is. However, this model does not internalize the effect of inequality on fertility rate.

4.2.1. Human capital accumulation and endogenous fertility approach

The endogenous fertility approach explains the relationship between inequality and long term growth rate through the effect on fertility rate and human capital accumulation.

According to this theory, fertility rate is positive related with inequality. Indeed, poor families, not having the possibility to invest in human capital, will rise their fertility rate, increasing the number of households per family and therefore the future family income. On the contrary, rich parents will opt for "quality" rather than "quantity". Indeed, the opportunity cost of raising a child in terms of time and loss in job opportunities will deter rich parents from rising their fertility rate, deciding instead to invest more in children's education. As also showed in De La Croix and Doepke (2003) countries with high income inequality, exhibit often an higher fertility rate. This results in capital dilution and lower human capital accumulation, preventing economic growth in the long run.

There is however, who thinks that during the process of development, even a country starting from a high inequality rate can achieve an higher steady state. About this Dahan and Tsiddon (1998), assessed an "inverted U-shaped" relationship between fertility rate and income distribution. According to this model, in the first stage of development, the low income share of population is not willing to invest in human capital and it opts for higher fertility rate. Indeed, the cost of borrowing is too high with respect to the return to education , due to capital market imperfections. The consequent excessive supply of low skilled labour force, lowers the wage rate. Meanwhile the richest share of population invests in human capital. The supply of skilled labour force rises less rapidly than that of low skilled workers. Therefore the premium on education increases and consequently also the gap between the wage of uneducated and educated workers. The consequence of higher return to education is that an increasing share of poor households, lowers the fertility rate and starts investing in human capital, rising the overall supply of educated workers. Consequently, the wage gap between the two groups declines, together with the level of inequality. This process of development is similar to that explained by Kuznets, and in its final stage a more equal society, a lower fertility rate and a higher investment in human capital have the effect of higher long run growth.

This model looks at a transition towards a unique steady state, but there are other models as that of Kremer and Chen (2000) that instead asserts the existence of multiple equilibria, which vary depending on the starting level of human capital. According to these authors the number of educated workers affects the long run equilibrium;

countries with low level of unskilled workers will tend to exhibit higher growth rates and lower income inequality levels, with respect to those countries whose labour force is composed mainly by unskilled workers.

According to the already mentioned models, a more equal redistribution of income boosts growth in the long run. However many economists, including Dahan and Tsiddon (1998), Morand (1998), suggest that sometimes a redistribution measure, could not have the desired outcome, if implemented prematurely in an underdeveloped economy. Indeed, the key assumption under all these models stays in the fact that whenever resources are more evenly distributed, the fertility rate tends to decrease, allowing the process of human capital accumulation. However, if this assumption falls, due to either too low average levels of human capital or low expectations about the future or lack in possibility of upward social mobility, then the effects of redistribution could potentially be only an increase in the fertility rate. This would lead to capital dilution, lower growth and stagnation in the long-run (Dahan and Tsiddon, 1998).

Koo and Dennis (1999) consider the rise in fertility rate by low income parents as a kind of insurance against their old age future. Therefore, according to these authors a transfer of income from rich towards poor individuals will cause overall to a lower fertility rate, since the effect on rich families would be negligible while that on poor families will be strongly in favour of a reduction in fertility.

The main results of this approach is that inequality is negative for human capital accumulation, due to the effects of higher fertility rate on capital dilution. Hence, redistribution policies towards more equality, are usually considered growth enhancing.

This is also in line with the classical theory, that strengths the importance of human capital accumulation for growth. Human capital is embodied in human beings and it is therefore physically constrained and not transferable. Consequently it can be accumulated only through widespread investment in education. Therefore inequality, especially in developed economies, has an overall negative effect on potential growth.

4.3. The effect of inequality on domestic market size

In explaining the effect of inequality on physical and human capital accumulation, it is assumed the neoclassical idea that supply drives demand and therefore the equilibrium

output level in the long run. However, under a more Keynesian way of analysing the problem even expected domestic demand influences the long term supply through entrepreneurs' investment decisions. Moreover, the distribution of income, affects the structure of domestic demand and therefore choices about the long run supply.

This way of addressing the problem of growth was firstly discussed in the "balanced growth" approach (Nurkse, 1968; Rosenstein Rodan, 1943), especially to explain the process of industrialization of developing economies. Under this model, the delay in the process of industrialization of underdeveloped countries, is explained by the small size of domestic market demand. However, this model does not internalize the distribution of income.

A balanced growth model which internalizes inequality was formalized by Murphy, Vishny and Shleifer (1989),who pointed out the big role played by the middle class for triggering a country development. Indeed, this static model considers all individuals equal except for their income. The society can be classified in three categories: poor agents, who consume only food, middle-class agents who consume either food or some manufactures and rich households, who consume all goods produced in a given economy. Under this model a country achieves growth in the long run only if it has neither a too equal nor a too unequal distribution of income. Indeed in the first case the economy would produce only food, no households could afford manufactures and the process of industrialization would not start. On the other hand an oligarchic income distribution shrinks the demand for manufactures. The economy does not benefit from economies of scale, therefore product differentiation is not achieved and many sectors are preventing from industrializing. Therefore this model suggests a positive effect on growth of a redistribution of income towards the middle class.

Another research paper by Jamarillo (1995) continues the reasoning started by Murphy *et al* (1989). It outlines the importance of a widen domestic market demand to make the adoption of modern production technologies profitable, increasing innovation and productivity. Higher productivity and innovation are, indeed, the key variables for a developed country to grow steadily in the long run.

4.4. The effect of inequality on productivity and technological innovation.

Productivity is a fundamental parameter in describing the competitiveness and future growth of an economy. It is strictly linked with technology and research, and it is also affected by the level of inequality of income in a given economy. This relation has been investigated either directly or indirectly in different papers and the results are not always straightforward. Indeed on one hand wage inequality represents an incentive to work. Employees are more willing to work hard and accommodate themselves to manager's demand in the hope that they might be promoted. This is actually true if either in the economy there is place for social mobility or the unequal distribution of income does not prevent human capital accumulation. Many papers go towards this direction.

A recent research by Mark Rogers and Guy Vernon (2002), assesses a double effect of inequality on productivity. Indeed inequality is considered an incentive to work better when it concerns the top half of the wage distribution, it is instead detrimental for productivity performance and growth when it concerns the bottom half of the distribution (M. Rogers G. Vernon, 2002). Indeed, as far as inequality does not prevent human capital accumulation, it can be an incentive to work hard and to wish social upward mobility.

Another paper from Zweimüller (2000b) also analyses how inequality affects innovation and hence long term growth. This paper finds either positive or negative effects of a more even distribution of income on growth. On one hand, an income transfer has a market size effect, since internal domestic demand for manufacturers increases and therefore growth. On the other hand, however it results also in a price effect. Indeed, when more people share the same income, and more rich individuals can benefit from innovation, the price of manufactures falls. Therefore the main finding of this paper is that whenever the market size effect dominates the price effect, because the innovator's market power is high, then less inequality has an overall positive effect on investments for innovation and hence growth.

Although Zweimüller (2000b) considers the market power of an innovator as necessary to sustain innovation after a redistribution, there is literature on managerial slack or X-inefficiency (Liebenstein, 1966), that instead is in favour of more competition to promote productivity. Indeed, especially if wage dispersion in the lower income share of population is high, according to Aghion (1999) there are no incentives for managers to introduce new technology for either cost reduction or product differentiation. Indeed managers do not face competition and they incur in low labour cost. Instead, the introduction of new technologies and innovations would become necessary whenever such low wages to workers were precluded.

Therefore to summarize, inequality is not completely negative for growth and innovation as soon as it involves the highest income share of population, therefore not precluding human capital accumulation and the development of a big manufacture domestic demand.

4.5. The Effect on Redistribution Policies and Efficiency

About the relation between inequality and growth, political economy stresses the importance of fiscal policy and redistribution of income in promoting or lessening growth. In the classical theory redistribution is endogenous and it is the result of the preferences of the majority of individuals toward the tax rate. Each household is indeed and economic agent who seeks to maximize his/her return, given by the difference between the tax benefit and tax costs.

The first models (Bertola, 1993; Persson et Tabellini, 1994; Alesina and Rodrik, 1994) assess a strong negative relation between inequality and long term growth, through the effect of distortionary taxation. The "endogenous fiscal policy" (Perrotti,1996) is summarized by the "median voter hypothesis" (Meltzer and Richard, 1981). Under this model all agents have to choose in a democratic way the tax rate for the redistribution policy. Assuming rational agents, each individual will try to maximize his/her expected payoff, comparing the benefit from redistribution (tax transfers and government expenditure) with the costs (direct taxes). Therefore the tax rate wished would be negatively related to agent's income. Given a perfect democracy where each individual has the same right and power, the final tax rate will be that wished by the median income voter. Therefore, in a very unequal society the tax rate will tend to be higher

than in a more equal society, since inequality is measured as the deviation of median income from the average income level. According to the traditional political economy an high tax rate has disincentive effects on investments. Therefore this theory suggests an overall negative effect of inequality on growth through the distortionary role of taxation.

However, there are several economists who do not agree with this line of though. Saint Paul and Verdier (1996) invalidated this reasoning about inequality and redistribution, relaxing some of the assumptions under the model. First, an increase of inequality can or cannot affect the median voter's income. Indeed, if the rise in income inequality involves only the upper or lower share of the population, the median voter could be unaffected and hence the tax rate. The second assumption, is that of a perfect democracy where each agent has the same political power. Even this assumption can be relaxed. Benabou (1996) analysed the same problem by considering a more complex framework where countries differ in their level of democracy. He realized that redistribution policies vary according to the level of democracy of a given country. In particular, the response on redistribution policies is stronger in left-wing countries than in right-wing regimes. The third assumption underlying the classical approach is that tax rates are flat instead of being progressive. Finally, Saint Paul and Verdier (1996) pointed out the different effect a tax has on the poorest and richest share of population. The former includes often wage earners and therefore workers paid by the public sector, with no possibility of tax evasion, while the latter involves employers or self-employed, who have more opportunities of tax evasion. Given these considerations, it may happen that poor people bear more heavily the burden of taxation than rich people, resulting in the fact that the majority prefers a lower tax rate when inequality increases.

In many paper by Ades and Verdier (1996), Agemoglu and Robinson (1996), Bourguignon and Verdier (2000a), it is relaxed the concept of perfect democracy in the endogenous political participation model and different outcomes are revealed.

In Ades and Verdier (1996), entry into politics is not any more free but it involves a fixed entry cost. In this paper society is split into two categories: the rich that can pay the entry cost and the poor who cannot. Therefore only the rich elite will be able to decide over the tax rate and share the returns among themselves, while the poor will

have to pay taxes without receiving any benefits. This model forecasts economic stagnation and increasing tax distortion and inequality in those countries with high level of inequality and high entry costs into politics. Conversely, those countries with low cost of entry in politics and a more equal distribution of income, will experience less tax distortion, long-run growth and a progressive reduction in inequality.

Even in Agemoglu and Robinson (1996), the political power is concentrated in the hands of an elite, but in this case poor agents can threat the current government with a "revolutionary technology", that is stronger higher is the disparity between the two classes. This threat, according to the authors, can force the elite to initiate a slow process of democratic transition, increasing the tax rate, hence income transfers and growth.

In conclusion, the classical approach considers inequality negative for growth, due to the distortionary impact of redistributive taxation. Indeed, a too high tax rate will not incentive investments, it is often inefficient and leads to deadweight loss for society. However in very unequal society it is desirable, to avoid political instability and illegal appropriation of resources by the mass .

4.6. The effects on political instability

The political instability channel (Gupta,1990; Perotti, 1994,1996; Alesina and Perrotti, 1994), focuses on the social costs of high income inequality. The general idea is that excessive inequality can trigger malcontent among the mass and rise rebellion and violence. Gupta (1990) mentions three forms of rebellions: the one of the masses against the regime, that of the elite against the mass of rebels and that within the regime that lead to coups. According to Agemoglu and Robinson (1999a) these forms of violence are very frequent in unequal societies characterized by non-democratic form of government. Moreover in these countries it is more likely to have frequent changes of political regimes, repressions and social unrest.

Other economists as Alesina *et al* (1992) Svennson (1998), Keefer and Knack (2000), have analysed the adverse effect of political instability on innovation and growth, due to a weak role of the law and an ineffective enforcement of property rights. Indeed the enforcement of property rights is fundamental for innovation and development. A weak

legal system does not prevent misappropriation, social revolts or inefficient allocation of resources due to bribes or lobbying. Moreover, the lack of property rights can lead to exploitation of common resources, resulting in the so called "tragedy of the commons". This scenario is the worst possible scenario to invest. Therefore, in these economies low investments and high capital outflows, bring a reduction of capital accumulation and finally they result in economic stagnation. Bourguignon (1999) calculates the cost of inequality in terms of criminality, social unrest, less incentive in tourism activities and lower foreign direct investment. He considers the first two problems to be proportional to the degree of relative poverty of the lowest percentile of the income distribution and the last two to be the economic results of a country social unrest.

Therefore Bourguignon (1999) like many other economists, is in favour of redistribution policies towards more equality, to stimulate investments hence long-run growth, by reducing social unrest, criminality and illegal activities.

6.The main theories of inequality and growth.

A part from the effects of inequality on each different factor of growth, in the last decades, several studies have tried to assess the overall true relationship between income concentration and economic development. However, given the complexity of this analysis, the results of these studies are not always coherent.

The majority of them assesses a negative relationship. Perotti (1993), Alesina and Perotti (1996), Persson and Tabellini (1994), consider a strong negative effect of inequality on growth through the channel of political instability. Kremen and Chen (2002) explains this negative relationship analysing the channel of human capital accumulation, according to which high inequality lead to low investment in education and therefore low economic growth. De La Croix and Doepke (2001), use the endogenous fertility approach to explain the effect of inequality on capital dilution and low long-run growth.

Although a few, there are some studies that instead found a positive relationship. The most important are that of Galor and Tsiddon (1997a,b) and the ones from Forbes (2000). In the former paper, Galor and Tsiddon (1997a,b) develop two theories to justify the positive effect of inequality on growth. The first one concerns the role, before explained, played by inequality to boost physical and human capital accumulation in underdeveloped countries, allowing their economies to "take off". The second explanation regards the positive effects, inequality has in fostering hard work, mobility of skilled workers in technologically advanced sectors, and increase innovation. Forbes (2000), starting from this study, through panel estimations, challenges the belief that income inequality has a negative effect on a country economic growth, distinguishing the effect in the short-medium run and long run. In his paper he found a positive effect of inequality on growth in the short-run.

There are even studies that found a nonlinear relationship between these two variables. The most important to mention that of Banerjee and Duflo (2003) and those by Barro (2000,2008). The former studies the effect of changes in inequality on economic growth in the short run. This paper considers the channel of redistribution conflicts and political instability. According to Banerjee and Duflo (2003), if an economy is able to reach an

equilibrium level of inequality so that no distributional conflict arises, at that level, the growth rate will be maximize. In this case, any variation in the redistribution policy will lead to lower growth, independently if it is in favour of more or less equality. Barro (2000) and (2008), utilizes the imperfect capital market approach and therefore the problem of credit rationing to state that inequality is good or bad for economic growth, depending on the initial GDP level of the country. He found a Kuznets U-inverted relationship, according to which inequality is negative for poor countries and it turns to be positive for wealthy economies. Therefore, in his theory redistribution is positive in poor economies and it turns to be negative in countries with high income per capita. The break point level he found is $2000 (1985 US dollars) in Barro (2000) and $11,900 (in 2000US dollars) in Barro (2008).

6. A new approach to the problem.

All the models described above try to assess the quality of inequality so *if an unequal distribution of income is positive or negative for the economic growth of a country*. However, as explained by Milanovic in his book *The Haves and the Have Nots* , inequality "exists when there is society". It comes out from the relation between individuals, and from their unequal abilities and skills. Therefore, it seems to be "natural" for an economy to have a degree of concentration of income, especially in a market economy that tries to reward the abilities and the effort of each individual according to his/her marginal productivity and merit (Jorge Charles-Coll, 2012).

Therefore, according to this point of view, inequality is neither good nor bad, it is just a matter of "quantity". As a drug that can be lethal, if ingested in big quantities but at the same time can be curative if taken in small amounts, also income inequality can have different effects depending on its degree level.

This approach was presented the first time by Cornia *et al* (2004) and implemented empirically only in a paper by Jorge Charles-Coll (2012).

In this paper the author tries to demonstrate two main facts. The first one is the significance of the variable *inequality* in determining growth. The second is the existence of an "*Optimal Rate of Inequality (ORI)*" which maximize growth. Indeed, while equality is positive for growth, for the reason explained above, a too strong redistributive policy can turn to have negative effects for an economy development. In his theory the author mentions also the problem of inequality traps a country can face if the taxation system is underdeveloped and the marginal efficiency of redistribution is very low.

6.1. The optimal balance between an high level of inequality and a too distortive taxation.

Redistribution, is fundamental to avoid too high level of income inequality and all the negative effects of such concentration of income. However, as explained before in the paragraph about the distortionary role of taxation, an high tax rate is not always desirable. Perrson and Tabellini (1994) pointed out that one of the reasons why

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inequality is bad for growth is precisely the potential too high tax rate set in a more unequal society.

Under this model, what is tried to figure out is the level of inequality that a given government has to achieve to reach a maximum potential level of growth. Indeed, economies usually tend to income concentration and higher inequality .This is why fiscal policy and redistribution are necessary to maintain the right balance.

In Jorge Charles-Coll's (2012) model, there are some hidden assumptions that are important to mention in order to understand why this model can lead to different results from those early discussed. First of all, inequality and redistribution are not strictly correlated, in the sense that the "median income voter theory" does not necessary hold true. Indeed, in this model it is possible to have at the same time high inequality and policies in favor of high redistribution or conversely low inequality and low taxation. This is possible due to the fact that the tax system is analysed in its complexity. It is an instrument through which redistribution takes place, that can be more or less advanced. Therefore, the efficiency of the tax system is not maximum as in the neoclassical approach of the median income voter but it can have several degree of efficiency. This more realistic view was already included in the papers by Bénabou (1996) and Saint Paul and Verdier (1996). The former, allowing for different level of democracy, therefore relaxing the assumption of political power shared evenly among the entire population, while the latter mentioning the fact that high income classes have more "opportunities" to evade tax payments than poor ones.

Jorge Charles-Coll (2012) individuates three possible scenarios, in which the relationship between inequality and redistribution leads to different outcomes.

The first scenario: an economy with high inequality and low redistribution

In this situation a country level of inequality is too high and the political parties do not take advantage of the potential benefit from redistribution. The country falls in the right part of the curve below (indicated by Y_2). The economy does not reach its potential maximum growth and the effects are those stressed by those theories that consider a negative relationship between inequality and growth.

The second scenario: an economy with low inequality and too high redistribution and taxation

In this state of the economy, the potential benefits from redistribution are totally offset by the distortionary effects of high taxation. Indeed, in an enough equal society there is no need of further redistribution to boost human capital accumulation and increase domestic market demand. In this case further taxation can only have a negative effect on investments. Indeed, as the classical models suggest (Persson and Tabellini, 1994, Alesina and Rodrik, 1994), a too high taxation is a disincentive for investments and output growth. Furthermore, inequality as explained in the section about its effects on productivity, can also affect positively growth if it involves the top half of the wage distribution (Mark Rogers and Guy Vernon, 2002). Therefore, under this scenario more inequality is desirable to increase growth. Countries falling under this scenario are those which lie in the left part of the graph (indicated by Y_1)

The third scenario: the perfect redistribution policy

In this case, the economy is at its maximum potential. The difference between the benefits and cost of redistribution is maximized and the related inequality level is that which leads to the highest potential growth rate. This level of income inequality is what Jorge Charles-Coll (2012) calls "*Optimal Rate of Inequality"(ORI).*

Fig. 1 The optimal rate of inequality and the relationship between redistribution, inequality and growth
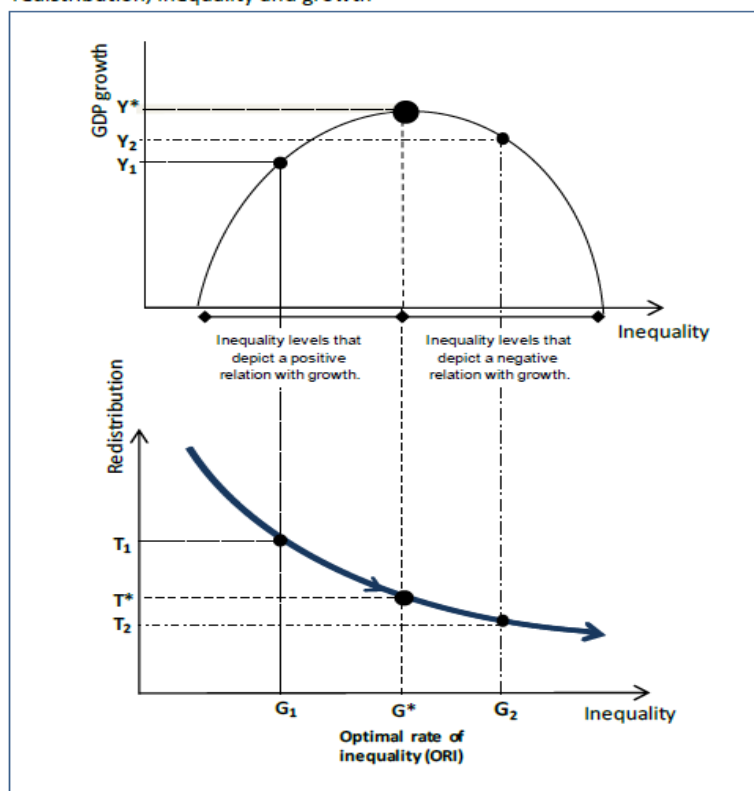
Sources: Jeorge Charles-Coll (2012)

According to Jeorge Charles-Coll's model (2012), the sign of relationship between inequality and growth assessed in the previous studies, tells in which scenario a country is of the three early mentioned. Therefore, fiscal policy, hence redistribution, is the main instrument a government has to achieve the ORI. For example, a country that has a too high level of inequality and low redistribution policies, will fall under scenario number one. In this case, ah higher taxation rate and more redistribution are needed to reach the ORI, which is not at all an equilibrium point. Indeed this point can be reached only through a deep analysis of the macroeconomic conditions of a country, an intelligent use of fiscal policy and the development of an efficient tax system. Econometrically speaking, when the ORI is reached «*the correlation between inequality and growth will become insignificant*»(*Jeorge Charles-Coll, 2012, page 5).*

6.2. The importance of an advanced tax system

In the model by Jeorge Charles-Coll (2012), a very important role is played by the efficiency of the redistributive system. Moreover, what is implicit about the

redistribution process is that it is built to pursue a more equal distribution of income. The final aim of redistribution consists in allowing even the poorest share of population to access higher education and potential upward social mobility. The tax system has to provide not only education but also health assistance and all those fundamental facilities to promote growth. Among the main objectives of an efficient tax system, Steinar Strom (2002 stresses the role of redistribution for the entrance in the labor market of the weakest classes of society, who are much more encouraged to leave the labor market when an higher tax burden lower their wage level. Therefore, this study assesses the importance of a redistributive policy toward the poorest share of population, to increase labor supply, to reduce efficiency deadweight loss and increase equality.

James Alm in *The National Tax Journal (March 1996)* lists the main qualities of a virtuous tax system:

> *<<taxes must be raised (**revenue-yield**) in a way that treats individuals fairly (**equity**), that minimizes the interference in economic decisions (**efficiency**) and that does not impose undue costs on taxpayers or tax administrators (**simplicity**)>>*(The National Tax Journal (March 1996),pag117).

A tax system that maximizes all these principles at the same time is an utopia. However, the more the tax system satisfies this principles, the higher is the *Marginal Efficiency of Redistribution*, *(MER)* (Jeorge Charles-Coll, 2012). Another important aspect which affects the effectiveness of a tax system, is its enforcement, through the minimization of tax evasion and the limitation of black economy. Hence, the government has not only to design the right tax policy, but it must also enforce it effectively.

The higher the Marginal Efficiency of Redistribution, the stronger will be the effectiveness of any change in policy.

This model by Jeorge Charles-Coll (2012) empirically gives an explanation on why different countries, which put in force similar level of redistributions, can actually differ in their level of income inequality. At the same time it also explains why there are countries, which need to enforce very different levels of redistribution to achieve a similar level of inequality.

6.3. The risk of inequality trap

In his paper, Jorge Charles-Coll (2012), gives also an explanation on why sometimes an high taxation level is not enough to achieve more equality and growth . He calls these scenarios with the term *inequality trap*. Those countries with a too underdeveloped redistributive system and an economy characterized by either high tax evasion or a large underground economy, are likely to fall in such bad scenarios. In these cases, even with a significant rise in the tax rate, these countries will never be able to reach the ORI (see the figure below). This raise in taxation will burden just a small percentage of the population, rising the distortionary effect of taxation and never ending in higher economic growth. Therefore, Jorge Charles-Coll (2012) suggests as the only way to overcome the problem a development of the tax system and a series of reforms and actions aiming at reducing those negative externalities, as tax evasion, which prejudice the effectiveness of the redistribution policies.

Fig. 2 Underdeveloped redistributive systems and the inequality trap
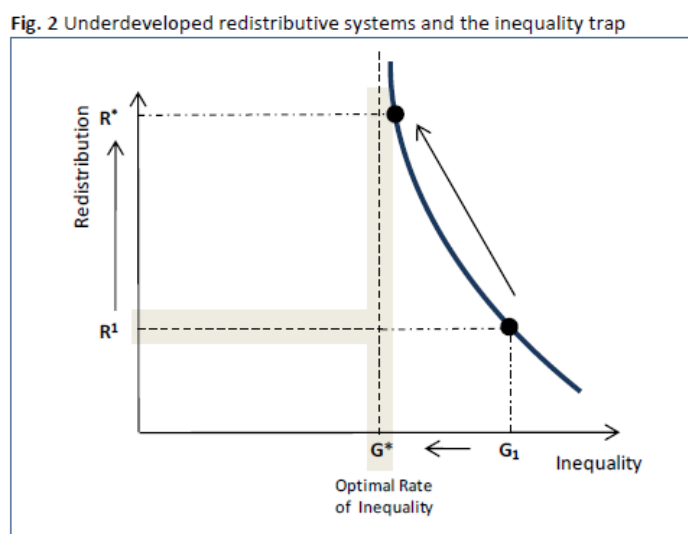
Sources: Jeorge Charles-Coll (2012)

7. Empirical evidence: the econometric study.

7.1. The econometric model and the purpose of the study

This paper wants to prove a second order relationship between income inequality and growth. More precisely, the relationship between these two variables, according to the theory should be positive for low values of inequality and negative for high values, resulting in a characteristic concave down parabola. In this econometric model, some control variables have been introduced to isolate the effect of inequality on growth. These are: the fertility rate, the investment ratio as percentage of GDP, the level of education achieved by the population, the degree of openness of a country's economy.

Furthermore, to assess the validity of such relationship it is also necessary to isolate the country intrinsic characteristics, minimizing the problem of potential omitted variable bias. Hence, panel data estimations have been implemented. They allow to control for unobserved variables that differ from one state to another but do not change over time. For example, culture, geographical position, climate conditions and natural resources endowments are all factors which affect economic growth of a country but are difficult to measure. Panel data estimations allow to incorporate the so called "time fixed effect". Moreover, time dummy variables have been introduced to eliminate distortions due to time effects only, as it could be a strong economic downturn or a supply oil shock. Using both Country and Time Fixed effects, we try to minimize the problem of omitted variable bias.

The program used in this paper to compute all the statistics is Stata 11.1. The command which allows for panel data estimation is *xtreg*. With the option *fe,* it fits fixed effects models by using within regression estimators (Stata).

The basic growth model of this paper is:

Growth= ß1 Inequality + ß2 Inequality^2 + ß3 Investment Ratio + ß4 Government Share of GDP+ ß5 Fertility + ß6 Price level of Investment + ß7 Openness +ß8 Education

7.2.Data description

Our empirical study uses a sample of 90 countries in the time period between 1963 and 2002. The final dataset is the result of the merge of four different databases: EHII2008 (Estimated Household Income Inequality Data Set), Penn World Table mark 6.3, Barro & Lee (2010) for education records and UN Dataset for fertility rate. The final dataset is composed by the smallest sample of countries for which there were sufficient records for all the variables included in the regressions.

The variable "Inequality", which is the one we are analyzing is measured by the Gini coefficient. It has been taken from the dataset EHII2008 (Estimated Household Income Inequality Data Set). This dataset was set as the master database. It is a global dataset, which has been computed from an econometric relationship between UTIP-UNIDO and the World Bank's dataset Deininger & Squire. Originally this dataset had 3,513 observations and it recorded values of inequality for 154 countries between 1963 and 2002. At the end, the availability of data for other control variables and the dependent variable, resulted in a smaller sample of 94 countries, which were further reduced to 90, due to the decision of eliminating Iran, Iraq, Syria and Libya. Indeed, these countries showed too extreme values for the dependent variable "Growth Rate". The variable inequality has a mean of 40.074, a median of 40.7567 and a range of values that goes from a minimum of 19.81 to a maximum of 64.36. The Gini Index here is expressed in integer numbers, so it could take values from 0 to 100.

The dependent variable "Growth Rate" was obtained from the Penn World Table mark 6.3. Differently from the paper by Barro (2008) and the paper by Jorge Charles-Coll (2012), which valued the effect among fixed periods 5 years long, to reduce the effect of business cycles fluctuations, in this paper the dependent variable was kept in its yearly statistics.The Penn World Table mark 6.3 has been used also for control variables such as: the investment share of Real Gross Domestic Product per Capita and government share of Real GDP per Capita. This is a fundamental dataset for macroeconomic studies, since it contains national accounts of many macroeconomic variables for 189 countries and it is continuously updated. Penn World Table mark 6.3 contains panel data for time

period 1950-2007. However, given the necessity to merge all data together, only values for the period 1963-2002 have been used. The growth rate used in the regressions, labeled *grgdpl2* is growth rate of Real GDP Laspeyres2 per capita measured in 2005 current price. This variable is measured in percentages and it has a mean value of 2.386. Its value has a wide range which varies from a minimum of -40.187% to a maximum of 71.998%.

The control variables related to education and hence human capital accumulation have been found in the dataset by Barro & Lee (2010). The initial dataset records values for 146 countries by five years from 1950 to 2010. Assuming an almost constant level of educational attainment within this five-year time, these values have been expanded to have records for each year. The variables used to control for level of educational attainment is the sum of primary and secondary years of school attainment, called *yr_sch_sec* and the percentage of no schooling *lu.*

Finally, to assess the importance of an efficient tax system and redistribution policy in a given government, another variable called *Redistribution* has been introduced. A variable that could approximate the efficiency of a tax system is not easy to find. Indeed, values of tax evasion and loss in redistribution efficiency are not available. Therefore, the variable used was the public expenditure on education as a percentage of total GDP. This statistics partially describes the efficiency of a redistribution system if we assume a redistribution policy in favour of more investments in education, to be growth enhancing and therefore efficient. The same variable for the same purpose was used by Jorge Charles-Coll (2012) in his paper. The dataset including this variable is taken from the UIS Data Centre. The original database records values for 187 countries in the time period 1975-2010. However many years were missed, therefore, after having assessed that the percentages were almost constant for each country over time, a unique average value was computer for each country, building a cross section variable. *Redistribution*, measured in percentages, has a mean value of 4.12, with a standard deviation of 1.57 and a range that goes from a minimum value of 1.32 to a maximum of 10.73.

The final dataset is composed by 90 countries, which are grouped in seven categories: Middle East (nine countries), Sub-Saharan Africa (sixteen countries), Latin America

and the Caribbean (nineteen countries), Advanced Economies (twenty-two countries), South Asia (five countries), East Asia and the Pacific (eleven countries) and Europe and Central Asia (eight countries).

Table 1

Variable	Definition	Source	Obs	Mean	Standard Deviation	Min	Max
GDP Growth	Growth rate of Real GDP per Capita 2005 constant price	Penn W.T Mark 6.3	3408	2.19	5.67	-40.187	71.998
Inequality	Gini Coefficient	EHII2008	2785	40.074	7.012	19.810	64.360
Investment Ratio	Investment Share of Real GDP per Capita, 2005 constant price	Penn W.T Mark 6.3	3422	21.68	10.67	-12.92	65.59
Price level	Price level of Investment	Penn W.T Mark 6.3	3422	71	57.06	.293	1707.95
Government Share of GDP	Government Share of Real GDP per Capita, 2005 constant price	Penn W.T Mark 6.3	3422	16.56	7.96	.83	73.47
Fertility	Fertility rate	UNESCO Dataset	3400	3.82	1.99	1.18	8.11
Education: *Yr_sch_sec*	Sum of primary secondary school attainment	Barro &Lee (2010)	3600	1.69	1.19	.0257	5.72
lu	Percentage of no schooling		3600	25.53	25.4	0	93.6
Openness	Openness in 2005 current price	Penn W.T Mark 6.3	3422	70.41	49.2	5.08	428.44
Redistribution	public expenditure on education as a % of total GDP	Barro & Lee/ UNdata Data Centre	3480	4.12	1.57	1.32	10.727

7.3. Estimations and Results of the regressions.

This empirical study aims at confirming the second order relationship between inequality and growth theorized in the model.

First of all a linear regression is computed to definitely assess the inaccuracy of a linear relationship in describing the effects of inequality on growth. Data confirm the expectations. Indeed, the coefficient of the term inequality is negative, as attested by the majority of the researches in the field, but it is not statistically significant.

In regression (2) the second order variable *Inequality^2* is introduced. Also in this case, the model expectations are backed by empirical findings. Indeed, the coefficients for inequality and inequality squared are both significant at 1% significance level. Furthermore the second order variable exhibits a negative coefficient, supporting the hypothesis according to which the relationship shape is a concave down parabola. These estimates confirm that at low level of inequality less redistribution is positive for growth, while when this level is sufficiently large, more redistribution is needed otherwise the potential growth of an economy falls.

In regression (3) the 90 countries of the final database were divided into two groups: advanced countries and non-advanced countries. This model aimed at assessing if the relationship between inequality and growth would differ according to a country level of development. Indeed, as explained in the first part of the paper, many theories hypothesized different effects of inequality on growth according to the level of development of an economy.

This assessment was done through the creation of an interaction dummy variable (inequality x advanced countries). Regression (3) aimed at verifying if the two concave down parabolas (developed and underdeveloped economies), were coincident or they were shifted horizontally resulting in a different ORI (Optimal Rate of Inequality) for the two groups of countries. However no significant differences in the relationship between inequality and growth for the two groups of countries came out. Indeed, the linear and quadratic coefficients of the dummy variables "inequality x advanced

countries", are not statistically significant. However, the coefficients of inequality and inequality squared keep being statistically significant at 1% confidence interval.

For what concerns the control variables: fertility, investments as percentage of GDP, economic openness, price level of investments and education, the econometric estimations do not confirm the theoretical expectations for all the variables.

More precisely, *fertility* is in both regression (1) and (2) significant at 1% significance level and its coefficient shows the expected negative sign. Therefore the fertility approach, according to which higher fertility leads to more capital dilution and lower growth is backed by data. It is the same for the variable *Investment Ratio*. It is consistently significant at 1 % significance level in all the regressions reported in table 2. Its coefficient shows also a positive sign, confirming the theory according to which higher investments per capita lead to higher growth in the long run.

Instead, *education* does not confirm the expectations. Indeed, first of all it is never statistically significant. Moreover the sign of the coefficient is negative, while it was expected to be positive. However, this outcome is unexpectedly common in literature. In many empirical studies the variable related to Education turns to be insignificant. For instance in Charles Coll (2012) in the computations of 3SLS estimations *education* turns to be insignificant when not allowing for a differentiation between male and female school attainment. The insignificance of the education coefficient was also an outcome of the 3SLS regression by Barro (2008).

The coefficient describing economic *openness* is also never significant. However the effect of economic openness and trade on inequality and growth, has not been discussed in this paper. It is a controversial topic and it deserves a deeper analysis.

Table 2

Variables	(1) (linear regression)	(2)	(3)
Inequality	-0.0024 (0.035)	0.830*** (0.2637)	0.8638*** (0.297)
Inequality^2		-0.0098*** (0.0031)	-0.0102*** (0.0034)
Ineq x Advanced			-0.412 (0.965)
Ineq^2 x Advanced			0.0056 (0.131)
Investment Ratio	0.242*** (0.232)	0.244*** (0.0232)	0.244*** (0.0234)
Government Share of GDP	0.0362 (0.03)	-0.0325 (0.03)	-0.032 (0.0301)
Fertility	-0.876*** (0.238)	- 0.91*** (0.238)	-0.897*** (0.2403)
Price Level of Investment	0.0004 (0.0045)	-0.0011 (0.0046)	-0.0026 (0.0044)
Openness	0.011 (0.008)	0.0097 (0.0077)	0.0094 (0.0077)
R-Squared: within	0.099	0.118	0.118
between	0.14	0.224	0.02
overall	0.09	0.095	0.04

The regressions are all OLS regressions computed with panel data and with time dummy variables to control for both Country and Time Fixed Effect. The number in parenthesis are standard deviations and *** denoted 1% significance level, **5% and *10% significance level. When * is not reported it means the coefficient is not statistically significant.

7.4. The Optimal Rate of Inequality

The empirical study strongly supports the theory according to which the relationship between income inequality and growth is a concave down parabola. Therefore, it is straightforward that an optimal level of inequality exists. What this study has found is also that this point is unique and it does not vary according to the level of development of an economy.

The first and second regression give consistent results for the value of ORI, which is reached at a Gini Index of approximately 42 (ORI= $\beta 1/(2*\beta 2)=0.830/0.196=42.3=0.8638/0.204$).

The Optimal Rate of Inequality found in this paper is two percentage points higher than that calculated by Charles Coll (2012), which amounted to 39-40 Gini. This could be due either to a different sample chosen for the regressions or to different techniques in the empirical estimation. It is a qualitatively high value of inequality, especially if we consider that our sample average is approximately 40 Gini.

Figure 3
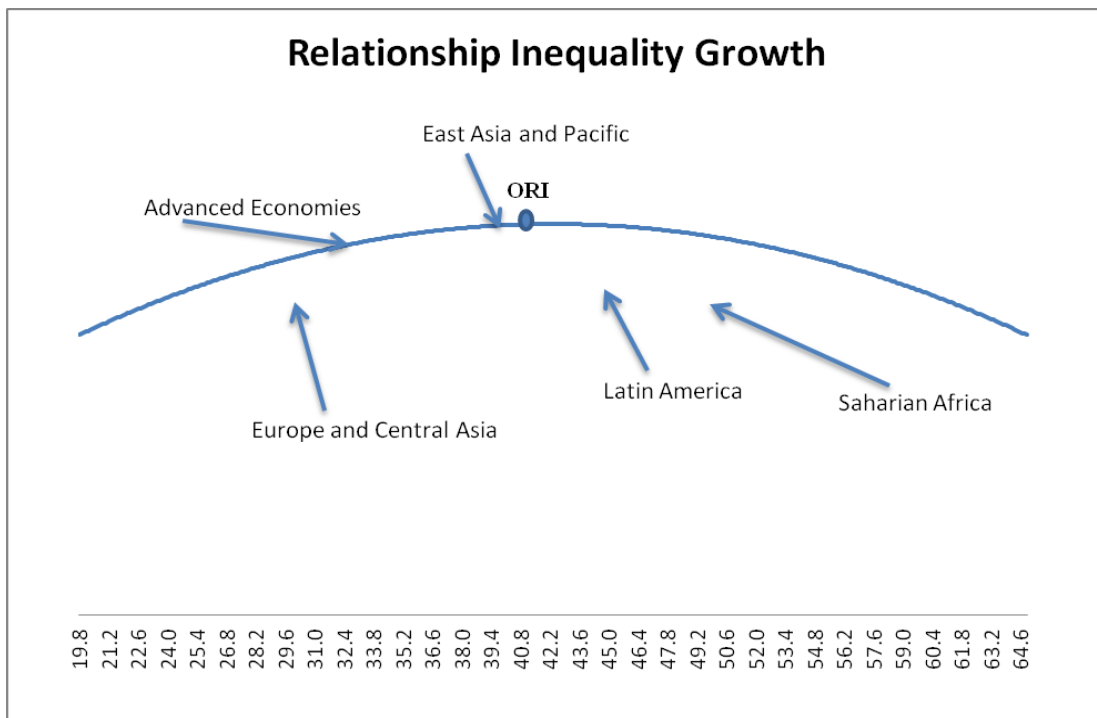
When averages of inequality and growth levels in the period 1960-2002 are calculated for the different groups of countries before mentioned, we have a picture of how these groups are positioned in the relationship. The african developing countries and especially *Sub Saharian economies* are those most negatively affected by the burden of high income inequality levels. They are caractherized by high income concentration and low growth, therefore they are positioned in the right lower part of the curve. (see figure 3). In these countries more equal redistribution policies are necessary to boost economy out of stagnation. *Latina America* is also affected by high inequality levels, even though less negatively than Sub Saharian countries, showing indeed higher growth rates. However in Latin American countries, according to the Interamerican Development Bank (IDB,1998), the huge income inequality level is strongly associated with large education differences. Estimates of IDB (1998) have assessed that in these countries an additional year of schooling can increase income by 12%. This is therefore a kind of inequality that most likely will perpetuate over time. Therefore, for Latin American countries more redistribution is recommended in order to reduce education differences.

Countries belonging to the region *East Asia and Pacific* record an average level of inequality in the period 1968-2002 of 41.18, a little bit lower than the ORI empirically found. This group, which includes countries as South Korea, Hong Kong, Singapore, Taiwan, Thailand, China, is the one whose average growth rate is highest in the period taken into account. They have also an average inequality level which is very close to the ORI found in this paper.

The *Advanced Economies* are caractherized by low level of inequality, and a more or less stable growth level, which does not reach its maximum potential. They are positioned in the left part of the curve. This finding is also in line with the Kuznets' theory according to which in the last stage of development income inequality falls due to a rise in welfare state, and due to a process of democratization.

Finally in the group *Europe and Central Asia,* there are mainly those ex communist countries as Bulgaria, Romania, Chzech Republic, Poland, which are characterized by either low inequality or low growth rates.

7.5. Empirical findings of inequality trap

The efficiency of a tax system is measured in this empirical study by the variable *redistribution*, that is defined as the level of public investments in education as a percentage of real GDP. Higher is this figure, more efficient the tax system is. When a descriptive analysis of countries average level of inequality and redistribution efficiency is computed, the negative correlation between these two variables stands out, suggesting the existence of inequality traps.

Table 3

Region Area	Average Inequality level	Redistribution efficiency
	Period 1968-2002	*Period 1968-2002*
Advanced Economies	34.92	4.69
East Asia and the Pacific	41.17	3.55
Europe and Central Asia	30.86	3.89
Latin America and the Caribbean	44.02	3.72
Middle east and North Africa	42.57	4.88
South Asia	42.36	2.09
Sub-Saharan Africa	46.13	4.4

Source: Data available in the final dataset described in paragraph 7.2

The descriptive statistics of table 3 confirm the theory according to which higher the efficiency of the redistribution higher is the effectiveness of policies toward a more equal distribution of resources. Indeed average inequality and redistribution efficiency are negatively correlated in almost all the seven region areas. The unique region whose figures are not totally in line with the theory is Sub-Saharan Africa, which has the highest average level of inequality and a quite high value of government expenditure in education as percentage of GDP. However, this can be due to the fact that having very low level of national GDP, those countries figuring in this region area would need an even higher percentage of public expendiures on education to boost economic growth. Furthermore, it is also important to highlight that inequality is only one of the many factors which affect economic growth in the long run.

Table 4

Country	Average Inequality level	Redistribution efficiency
	Period 1968-2002	*Period 1968-2002*
Australia	33.7815	4.50201
Austria	35.0553	5.07284
Belgium	36.0573	5.11958
Canada	36.0675	5.73993
Denmark	30.9495	6.79737
Finland	31.7241	5.39121
France	35.0077	4.48578
Germany	32.7743	4.22137
Greece	40.4147	2.14255
Iceland	36.1384	6
Ireland	38.2596	4.67518
Italy	35.7304	4.09037
Japan	36.3285	3.49569
Luxembourg	32.781	3.63545
Netherlands	32.821	5.21307
New Zealand	35.209	5.0192
Norway	32.304	6.12329
Spain	38.4847	3.47723
Sweden	27.9793	6.41799
Turkey	43.2304	2.04185
United Kingdom	30.349	4.74489
United States	37.0466	4.85796

Focusing on the group of Advanced Countries, table 4 confirms that all advanced economies are positioned on the left part of the inverted U shaped parabola (look figure 3). The only exception is Turkey, that in period 1968-2002 had an average level of

inequality of 43.2304 Gini, more than 1 percentage point higher than the ORI. Not surprisingly, Turkey has also the lowest level of public expenditure on education of the entire group area. These figures suggest a possible case of inequality trap for this country. Furthermore, the second lowest level of the variable *redistribution* is 2.14 and it is the figure for Greece, which is the country with the second highest records of level inequality within the group.

Bénabou (1996) studied the economic divergence of Philippines and Korea after 1960s in light of differences in inequality levels. It is interesting to see if these differences existed also over the efficiency of the redistribution policies. In table 5 these expectations are confirmed. Philippines invested 2.42 % of GDP in education, while Korea invested 3.47%. Therefore, Korea had a redistribution efficiency approximately 43% higher than that of Philippines and this resulted, as assessed by Bénabou (1996) in significantly different levels of inequality for the two countries. Philippines level of inequality in this period was 45.52, more than 6 Gini points higher than the related level for Korea.

Table 5

Country	Average Inequality level	Redistribution efficiency
	Period 1968-2002	*Period 1968-2002*
Philippines	45.52	2.42
Korea	39.2	3.47

These statistics confirm the importance of an efficient tax system to reach the ORI and to avoid falling in inequality traps.

8. Conclusions

The main finding of this paper is that there is in political economy a trade-off between the benefits of equality and the burdens of high taxation to achieve the above purpose. Indeed this cross country empirical study has confirmed the theory according to which an inverted U-shaped relationship between inequality and growth exists. It has been found that countries with inequality level below 0.42 Gini show a positive relationship between inequality and growth, while those with an income inequality above 0.42 Gini depicts a negative one. Therefore politicians ought to identify and reach the rate of inequality that maximizes economic growth.

In this empirical study the ORI is reached at 0.42 Gini. It is a qualitative high level of inequality, and it could be a suggestion to reduce taxation and redistribution especially in the group of advanced countries, whose average inequality level is 0.348 Gini. This value however does not tell the whole story. Indeed it describes the *quantity* that maximizes growth but it tells almost nothing about the *quality* of such inequality level. Indeed income inequality can affect very differently an economy potential growth if it involves the highest share of income distribution or the lowest. It can also be beneficial or harmful according to how much it rewards merit and hard work and it does not prevent social mobility.

Moreover, the aim of politicians can be also different from that of pure high economic growth. Sometimes social welfare is considered as important or even more relevant than a mere rise in GDP level. The advanced economies are an example. The majority of these countries has chosen more social security and a higher welfare state at the expense of lower growth.

However this paper findings can be a starting point for politicians to judge over the problem of income inequality and related redistributive measures. Moreover, it points out the fundamental role that an advanced tax system has, in order to achieve economic development.

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