

SUMMARY

ABSTRACT

The topic of inequality is faced from different perspectives in order to allow for a suitable comprehension. Before the theoretical examination, the principal metrics are presented, along with evidence upon the situation in history and in the present. Evolution of measurement methods and theories are tried to be explained, as well as the implication of studying inequality at different levels, in order to clarify the dynamics of inequality both from technical and theoretical points of view. In line with this a possible explanation for the increase of inequality occurred in the last years worldwide is proposed, which finds support in a theoretical framework, which is a composition of two notable models, that is presented. The reasons upon the proposal and the choice of such models are expound together with the presentation of some tests directed to verify the reliability. The results of such tests are reported and analyzed, finding a large evidence upon the implications of the models and on the original proposal.

INTRODUCTION

First of all, what exactly does income inequality means? For long time, it was treated as the dispersion of incomes within a national state and studied to assess the magnitude of poverty among inhabitants and areas of countries. Later on, with the availability of new size and types of data, the argument was faced from a cross-countries perspective. National data were compared in order to locate poverty and wealth concentrations among agglomerates and continents. Something that has been clear since the beginning of the studies, is that there is no point in studying inequality between two groups that do not interact with each other, at least not for anything apart from mere measurement, so attention has been put on analyzing inequality among peer (or reference) groups – i.e. groups of people sharing characteristics such as social and economic status, level of education and ethnic background.

Hence a natural question arises, what is a peer group today, and how we deal with that? Of course a globalized world brings some implications; the much increased movement of production factors across borders and the increased influence of other people's standard of living and way of life on our perceived income position and personal aspirations are among the reasons why such a grouping of people, if not removed, has being adapted to the new world dynamics. Along with it, also the topic's address has changed, towards the consideration of inequality among world citizens, or global; and as the world becomes more and more integrated, the global dimension of inequality is likely to become increasingly relevant. Global income inequality is indeed one of the most pressing current problems of our era and the relationship between inequality and growth is probably one of the most important in economics, which moreover has recently acquired added relevance because of the slowdown of growth and simultaneously rising inequality in rich countries. The revealed picture is that income inequality has increased worldwide and particular aspects are highlighted by recent estimates . In 2012, 12.8% of world's population, about 900 million people, lived at or below \$1.90 (2011 PPP) a day, which is the 2015 updated international poverty line; and looking at a higher threshold, over 2.1 billion people in the developing world lived on less than \$3.10 a day. If attention is moved to the situation at the upper end of the income distribution, it is reported than almost half of the world's wealth is owned by just one percent of the population. Moreover the wealth of the one percent richest people in the world amounts to

\$110 trillion, that is 65 times the total wealth of the bottom half of world's population (3.5 billion people), which is the same wealth that is owned by the richest 85 people on the planet . It has been also estimated that within 20 years the world is likely to see its first trillionaire, who will be holding a wealth of \$1000 billion; this is a lot more than almost every African country's GDP, and some European countries as well (think of Lithuania, which is the last country that entered the European Union with a GDP of \$50 billion in 2015).

Although poverty and income inequality are often mentioned in the same statement, they are very different concepts; while it is unanimously agreed that poverty is bad, it is less clear that income inequalities are undesirable. Obviously, redistribution has a central role in the whole discussion, and what is to be understood is not so much whether it needs to be applied, as the magnitude of its extent. Some economic inequality is essential to drive growth and progress, rewarding those with talent, skills and the ambition to innovate and take entrepreneurial risks; however, the extreme levels of wealth concentration occurring nowadays threaten to exclude hundreds of millions of people from realizing the benefits of their talents and work. This massive concentration of economic resources in the hands of fewer people presents a significant threat to inclusive political (due to the problematic effect that wealth concentration can have on equal political representation) and economic systems. The danger is that the increasing separation across people by economic and political power could light the fuse of social tensions and breakdown. Economic and technological development are unlikely to be alone the cause of such a wide and rooted inequality, the unrestrained research for mere growth sustained by pure profit oriented policies without much doubts is one. A fundamental remark that has to be made is that, while inequality is also found to affects positively growth, such a positive effect is exclusively reserved to the upper end of the income distribution, which means that the type of growth inequality stimulates is a growth that even more enhances inequality .

In this sense, the scope of the work is to gather evidences, theories and analysis methods that have characterized most the study upon inequality across the years; in the hope that the reader could acquire an overview on the subject that may be sufficient to understand the present inequality dynamics, and how these will evolve in the future. Moreover, there is an attempt to demonstrate the importance of applying redistribution policies as a means to easing within-countries inequality and the relative jeopardy social tensions. In the second section the reader finds a concise review of the principal inequality measurement methods and theories that have contributed in interpreting inequality dynamics. In the third section an effective model of endogenous growth and inequality is presented which has the purpose of demonstrate the positive effects of redistribution upon growth and individual wealth, with particular attention in the prevailing circumstance of imperfect capital markets. The fourth section, finally, is dedicated to the research of an empirical evidence upon the results of that model, and in general on the characterization of present inequality situation.

CHAPTER 1

Inequality can be measured in various ways and at several levels. Until the 2000s empirical literature, addressed to the convergence issue, has been concerned on estimating inequality within and among countries and two important properties have been postulated that any measurement method should satisfy in order to enter the class of relative inequality measures. The principle of transfers (also known as the Pigou-Dalton principle) states, in its weak form, that whenever income is transferred from a rich to a poor person while still preserving the order of income ranks, then measured inequality should not increase. In its strong form, measured inequality should even decrease. Scale invariance property, whereby richer economies should not be considered more unequal a priori, is the trait of homogeneity that an income inequality metric should possess: if every income in an economy is multiplied by any positive constant, the overall metric of inequality should not change. In other words, the inequality metric should be independent of the aggregate level of income.

Again, there exist many metrics performing the task of measuring income inequality and although they were discovered to behave very similarly and to be highly correlated, each has its peculiarity and fits to specific purposes. The most common inequality metrics are the Gini coefficient, the Theil index, the Atkinson index, the Robin Hood index, the 20:20 ratio and the Palma ratio.

The Palma ratio is actually used, together with the Gini coefficient and the 20:20 ratio, by the United Nations Development Programme to measure income inequality in almost every country of the world. In the 2015 Human Development Report it is outlined that among the category of “very high human development” countries, the 20:20 ratio varies from as little as 3 or 4 to as much as 10 or 12 with the most equal country being Slovenia (3.6) and the most unequal being Chile (12.6). It is also reported that in the UK the richest 20% individuals are nearly 8 times richer than the bottom 20% and in the US they are about 10 times as rich, with these ratios that have increased in the last decade. In the category of “low human development” the 20:20 ratio exceeds 10 in several countries and in some cases a factor of 20, with the most unequal country being Haiti, where the richest 20% is 26.6 times richer than the bottom 20%. Overall the calculations show that South Africa is one of the most unequal countries with the highest Palma ratio, the 10% richest individuals are 8 times as rich as the bottom 40%, one of the highest 20:20 ratio, the richest 20% are 28.5 times richer than the bottom 20%, and a Gini coefficient of .65. The OECD countries appear to be the most equal, with an average Gini coefficient between .25 and .3 and a Palma ratio up to 2.2, however, the 20:20 ratio exceeds a factor of 6 in some countries like Spain (7.6), Italy (6.9), Israel (10.3), in addition to the UK and the US (both with Gini coefficient around .4). The OECD countries also appear to be the countries that redistribute more, comparing the Gini coefficient estimations with gross and net income, the result is that redistribution has lowered the measured inequality by an average of 20 percentage points in the last decade. Recently, with the strengthening of phenomena as globalization, migrations and poverty, attention has moved for the empirical literature to the comprehension and the characterization of global inequality, inequality among world citizens. With regard to this question, while some authors have continued to estimate inequality through the mentioned metrics, some others have proposed and promoted new methods, in particular the use of household surveys, which are supposed to overcome the lack of comparable data that exist for some countries and allows, with due attention to national differences, to compare distant observations. For these reasons, the use of household surveys has overcome most of the other methods, in the perspective of reaching new achievements for the empirical literature, mostly with regard to global inequality, which fail to be represented properly by the standard metrics.

CHAPTER 2

Inequality topic, although relatively recent, has been addressed by many and faced with a variety of perspectives. The starting point is the original intuition, although erroneous, of Pareto (1897), according to which the distribution of income is essentially fixed in time. Half a century later, the interest was revived by Simon Kuznets (1955), who led the first important studies focusing on income inequality and economic development; analyzing cross-country data and time series, he found an inverted U-shaped relation between income inequality and GNP per capita. The Kuznets hypothesis was to link this result to the passage from a rural economy to an industrial one: income inequality should increase during urbanization and industrialization phases and decrease later on when industry attracts the great part of labour force.

However this trend has reversed by the end of the century, and income inequality has kept rising during the recent decades, stimulating new studies and theories. The 1990s, with the development of endogenous growth theory together with the availability of comparable data for a large cross-section of countries, have seen the literature focusing on the impact of inequality on growth. The majority of the studies carried in those years suggests that greater inequality reduces the rate of growth in a very unambiguous way .

An additional peculiarity of the period was for the empirical literature to provide insights over the channels through which inequality affects growth. Some authors highlighted the role of credit constraints and found that greater credit availability has a positive effect on the growth rate and the impact increases as the income share of the lowest two quintiles decreases, hence as inequality rises. Some others have put forward the role of macroeconomic volatility; measured by the standard deviation of GDP growth, it appeared to consistently reduce the growth rate as it discourages investments . Examining the impact of fiscal policy, Easterly and Rebelo (1993) and Perotti (1996) found that redistribution, measured by the marginal tax rate and different types of social spending, has a positive effect on growth. All of this results clash with the traditional view of economic theory that there is a fundamental trade-off between productive efficiency and social justice, that inequality is growth enhancing and hence that redistribution is harmful for growth. This concept is founded on three main thesis; first comes Kaldor's hypothesis that inequality positively affects growth because of the higher marginal propensity to save of the rich with respect to the poor, if the growth rate of GDP is related to the proportion of national income that is saved, more unequal economies would grow faster . This was actually formalized by Bourguignon (1981) in a Solow model where he showed that with a convex savings function, aggregate output does depend on the initial distribution and its level is higher along the more unequal steady state. A second reason has to do with investments indivisibilities: investments projects, particularly the implementation of innovations and the creation of new industries, are often characterized by large sunk costs; hence wealth needs to be sufficiently concentrated in order to allow some individual to cover them. The third is based on incentive considerations, due to Mirrlees (1971), who considered a moral hazard context in which output depends on unobservable effort; rewarding individuals with the same constant wage, independently from the (observable) performance would deter them from investing any effort. Summarizing, on one side redistribution reduces differences in income and hence lowers the rate of growth, on the other, as it is financed by income taxation, diminishes the incentives to accumulate wealth; thus the incentive effect of redistribution should always be negative. Overall, the empirical results contrast this vision and a possible explanation is based on the median voter hypothesis, according to which, when individuals are ordered by their factor income (i.e. income before taxes and transfers), the median voter (i.e. the individual with the median level of income) will be relatively poor in unequal societies. His income will be low in relation to the mean and if net transfers are progressive, she has more to gain from transfers than she would pay in taxes. This means that if inequality determines the extent of redistribution, more

voters in unequal societies are expected to prefer high redistribution; so if redistribution reduces the incentives to invest, and hence the growth rate, then more equal societies would grow faster. The median voter hypothesis has been tested and found support from several authors.

More recently, studies have moved from inequality among countries to inequality between world individuals, what Milanovic (2005) calls global or Concept 3 inequality. This concern is of course due to globalization, deindustrialization and physical and human capital mobility. Sala-i-Martin (2002) estimated global income inequality using popular indexes such as the Gini coefficient, the variance of log-income, the Atkinson index and the Theil index, using GDP and within-country income shares data for the period 1970-1998 to calculate. All indexes show an increase in within-country disparities during the sample period, but not enough to offset the reduction in cross-country disparities. This was largely attributed to the high growth rate of the incomes of the 1.2 billion Chinese citizens, and the author estimated that unless Africa starts growing, then China, India, the OECD and the rest of middle-income and rich countries will diverge away from it, and global inequality will rise again. Milanovic (2013) calculated global inequality using household surveys for the period 1988-2008.

Following his calculations, the results confirm that there was a decrease in global inequality, actually the first since the Industrial Revolution, though it can be sustained only if countries' mean incomes continue to converge. Apart from the empirical literature, some results came from the theoretical literature as well. One of the key points of the recent debate is the role of the labour market's dynamics and the technological change in explaining inequality. Acemoglu (2002) argued that the income inequality increase (within countries) during the last decades of the twentieth century was due to technological change, in particular to the fact that technological change has been skill-biased for most of the century and it has accelerated up to the early 2000s.

According to the author, this is recognizable by the behaviour of wages and returns to schooling. In the US inequality started to increase in the early 1980s as the college wage premium rose sharply, being one of the major motivating facts for the empirical inequality literature. Moreover, median wages stagnated in the same period and onwards while workers at the 10th percentile of the distribution (low-skilled) saw their earnings fall in real terms, even below the levels of a couple of decades before. The high level of schooling premium is the reason for the increase in the demand for skills and the acceleration in skill-biased technological change is then likely to have been a response to the resulting wide supply of skills. Although a tendency towards greater inequality has been a common feature in more and less developed countries, there are also marked differences in the within- and between-group inequality behaviour across them. As a matter of fact, while income inequality increased substantially in the UK and the US, it remained more stable in many continental European economies. An estimable explanation for this divergent behaviour is summarized by Krugman (1994); sometimes referred to as the Krugman hypothesis, it states that inequality did not increase as much in Europe because, there, labour market institutions have encouraged wage compression, limiting the extent of inequality.

Lowering the schooling premium would defer more people from getting skilled with this resulting in an augmented number of unskilled workers, meanwhile lowering their probability of being hired. Evidence was actually found, suggesting that minimum wage, strong unions and generous transfer programs in Europe were in part responsible for the relative wage compression. But this hypothesis has received some criticisms as well, in particular with regard to the prediction that profit maximizing employment decisions of firms should lead to a decline in the employment of unskilled workers, yet, in Europe, the unemployment rates of skilled and unskilled workers rose together. This may in part be due to the possibility for always faster skill-biased technological changes to decrease the employment rate of "out to date" skilled workers. Although this is a possibility, and deviations from the model above are in theory eligible due to bargaining arrangements between firms and unions, there still be lack of direct evidence on how far European economies may be off the relative demand curves. A considerable part of theoretical literature has

focused on the effects of inequality and redistribution on growth. One building block of neoclassical economics is the assumption that there are diminishing returns to capital, and it is precisely this assumption that drives the familiar convergence results both at cross-country level - as in the Solow model - and for individuals, although these results rely strongly on the existence of perfect capital markets.

It is a well known fact that this last assumption fails almost always in depicting the real situation and as Stiglitz (1969) first pointed out, when capital markets are imperfect, and returns to capital are decreasing, individual wealth does not converge to a common value and aggregate output may be affected by its distribution among individuals.

Following the standard growth model, he assumes that total output is produced by the aggregate stock of capital; when individuals are limited in their borrowing capability, wealth distribution affects their production possibility. This results in a negative impact on the aggregate output level and also, in an endogenous growth model, on the rate of growth. Galor and Zeira (1993) put forward an influential model of endogenous growth with an extreme form of capital market imperfection: there is simply no consideration for the credit market, as any possibility of borrowing and lending is assumed away.

Due to decreasing returns to individual capital investments, the rich have a relatively low marginal productivity of investments, while the poor have a relatively high marginal productivity of investment, though they are limited in investing at most up to their endowments. Then a redistribution of wealth from the rich to the poor would have an enhancing effect on aggregate productivity and hence on growth. Redistribution creates investment opportunities in the absence of perfect, or at least well-functioning, capital markets. The question of inequality is still an open subject and economic theory must continue to take into account new evidence coming from the so many studies carried out worldwide. In the next section a model is presented, which is focused on recognize the opportunity enhancing as well as the positive incentive effects of redistribution.

CHAPTER 3

In the context of the analysis on the effects of inequality on growth it is essential to consider the role of redistribution, since, as in Galor and Zeira (1993), it is unlikely for an economy to start with equal conditions among individuals and the initial distribution of wealth, determining the investment in education and bequests to the offspring, in turn affects both aggregate output and the long-run distribution of wealth and skills. To clarify, there is no attempt aimed at asserting that inequality is harmful for economic growth itself – although it may be argued that it is in regard to social and ethical aspects – because it is not so. There is just the one of try to prove that growth may be improved moving towards more equal systems. Hence, the reason why the two following models have been chosen to render in a theoretical framework the income inequality issue, and most of all its relationship with growth; is because of their consideration for heterogeneous individuals and credit market imperfections, which is here assumed to truthful represent the actual situation of economies, within a model that accounts for the most relevant assumption characterizing neoclassical economics.

In line with this, the particular formulation which is used is a theoretical model formalized by Bénabou (1996) which draws its foundations from some underlying ideas behind the work of Galor and Zeira such as learning by doing and knowledge spillovers. The former is the property for individuals of learning the more, the more they produce in a certain period, hence heightening the overall level of knowledge available in the next period. The presence of knowledge spillovers implies that the learning accomplished by an individual increases the knowledge of all other individuals and thus the general technology level. The level of technology is thus endogenous exactly because of this two elements. The starting point is an endogenous growth framework in which externalities in capital (physical and human) accumulation drive growth; individual production generates spillovers and this implies that individual production functions differ from the aggregate one.

A first result is that, with perfect capital markets, all individuals will choose to invest the same amount of capital no matter the initial disposal of wealth among them. The reason is that the opportunity cost of investing is the same for lenders and for borrowers, it is just the interest rate; so everybody in the economy wants to invest up to the point in which this one is equal to the marginal product of capital. In the specific, those whose wealth is above such level lend and those whose wealth is below it borrow. Hence, in the case of perfect capital markets, the distribution of wealth does not affect aggregate output nor growth. However, as stated above, the interest is in the results of a model whom takes into account capital market imperfections, which is a more realistic situation. As argued by Aghion, Caroli and García-Peñalosa (1999), when capital market imperfections pour in a scarce and costly credit, equilibrium investments under *laissez-faire* will remain unequal across individuals with heterogeneous endowments.

The assumption of decreasing returns with respect to individual capital investments – i.e. the fact that the production function is concave – makes it for a larger inequality across individuals, with a given level of aggregate capital stock, to reduce total output. Therefore, the more unequal the distribution of individual endowments, the lower the investments and hence the lower the growth rate of the economy.

There is now a need to verify the role of suitable redistribution policies and, in particular, if they may have an enhancing effect on productive efficiency and growth. Consider then a simple *ex-ante* redistribution of wealth, consisting in the direct taxation (through a lump sum tax) of high endowments and in the consequent subsidy to less endowed individuals using the revenues from that tax.

Notice that as a lump sum tax, it does not change the returns to the capital investment; it only influences the incentive to invest insofar as it modifies the available wealth of the individual. As the tax rate increases, that is as the distribution of disposable endowments becomes more equal among the agents, the poor (low endowment) will invest more while the rich (high endowment) will invest less. However, recalling that the production technology exhibits diminishing returns to individual capital investments, the overall effect of such a redistribution on total output and on growth, is expected to be positive. This is clearly due to the higher marginal returns to investment of less endowed individuals with respect to the ones with an higher endowment. The mechanism is not complicated: the poorly endowed, who, until the redistribution is put on place, have underinvested because of their economic situation, may now start to invest and, most important, they do so being figuratively on the steeper part of the capital investment curve. Prosecuting on that curve, for higher levels of invested capital, the productivity corresponding to such investments becomes increasingly lower and this is why the augmented possibilities of the poor are expected to move the overall effect toward positive levels.

To conclude, when credit is unavailable, redistributing to the poor – those who show the highest marginal return to investment – is growth enhancing; and remarkable is that this opportunity creation effect of redistribution still remains when the poor invest all their initial endowment rather than maximize an intertemporal utility as in the case above, as well as when others are the sources of capital market imperfections, such as moral hazard or repayment enforcement problems.

In order to challenge the traditional view and especially the Mirrlees hypothesis of redistribution having always negative incentive effects, Aghion and Bolton (1997) introduced moral-hazard considerations as the source of capital market imperfections in a framework similar to the one above. Here the cause of moral hazard is the limitation of liabilities, namely the sum that a borrower owes to the lender cannot exceed her own wealth. To easily depict the concept, consider the limit case of an individual with zero wealth who needs to borrow to invest in a risky project, whom probability of success is assumed to depend on the – somehow costly – effort the individual exerts. If the project succeeds, the individual earns the output minus the borrowed amount, while if it fails she incurs no loss since she has not invested own funds. Therefore, the optimal amount of effort exerted by the borrower would be less than what the lender expects. The more an individual needs to borrow, the larger the fraction of marginal return she has to cede to the lender, hence the less incentives she has in endeavouring. In other words, because the effort supply is decreasing in the amount borrowed, the repayment must be proportionate to ensure that the lender obtains the same expected reimbursement. The poorer the borrower, the higher would be her repayment to compensate for a lower probability of paying back. Then it can be stated that a redistribution toward borrowers would have a positive incentive effect on their effort supply; as long as this incentive more than compensates the consequent negative effects on lending, then such a redistribution would be growth enhancing relying on incentive considerations.

For a given interest rate, the lower the individual's initial wealth, the less effort she would exert in the investment project, lowering its probability of success. It is important to remark that, the lenders will systematically exert the first best level of effort, because they are the only claimants on all the revenues resulting from that effort. Moreover, although the repayment rate is assumed constant in the formalization, it actually may vary with w because the default risk increases with the size of the loan, in such a way that movements of r reflect changes in the default risk; however Aghion and Bolton (1997) have shown that, even when the repayment rate is free to fluctuate, effort is still increasing in the endowment.

If assumption of moral hazard is violated, that is if capital markets are perfect, every individual in the economy would exert the first best level of effort, the distribution of wealth would be irrelevant. When instead the presence of incentive problems makes the capital markets imperfect, a larger inequality (larger number of individuals with original wealth below the threshold) would

result in a lower aggregate level of effort and thus it would negatively affect both income and growth. Lastly, moving to the analysis of redistribution, taxing the above-threshold endowed individuals – i.e. the lenders – through a lump sum tax and distributing the proceeds among the borrowers would not affect the first best effort supplied by the lenders, whose after-tax endowment remain strictly above the threshold and it would increase the effort supplied by the less wealthy. Hence a redistribution of this type would have positive incentive effects on output and growth, though the question about its self-sustaining received a negative answer, as argued by the authors; redistribution policies must be sustained over time to have long-lasting effects on output.

CHAPTER 4

Economic models are created with the scope of representing specific dynamics happening in the real world and when they are well designed, it is to some extent possible analyzing similar situations relying on them and predict future occurrences. Though a common trend regarding theoretical literature about inequality is that, for so many formalized models, few are accompanied by empirical evidence. Even if a model seems to fit the real dynamics, it is essential to find proofs that it actually does, trying to find some empirical evidence. Hopefully, this is the extent here; although the available data on the inequality topic are still scarce. The test is thus accomplished for a selection of countries among the few high quality data are available for. According to the above modeling, redistribution has two notable implications, which are positive incentive and opportunity creation effects. In order to find evidence to support these conclusions, a test is realized to verify whether those may actually summarize a real situation. Following the second part of the model, a clear result is that redistributing in favor of less wealthy people does produce a positive boost for their effort incentives. In other words, an equal economy allows for more borrowers to succeed in their investment projects. The idea behind the test is to investigate whether redistribution policies effectively makes the credit market more robust, shrinking the amplitude of moral hazard implications, studying the correlation between redistribution and credit market failures. This is put into practice using the banking sector variable of non-performing loans to total gross loans rate (NPL) as a proxy for the magnitude of credit channel troubles, and regressing it onto the difference between the Gini coefficient calculated on disposable income after taxes and social transfers (pensions included) (RED) and the Gini coefficient calculated on market income (this is done to give redistribution a nonnegative dimension), which is a proxy for the redistribution extent.

For the case of Italy, the regression shows a definitively negative relation between the two variables which is assumed to mean that redistribution has a positive effect on the reduction of the failures of the credit market; namely an increase of the redistribution extent results in a decrease of the non-performing loans rate. In other words, the more equal a country's income distribution is, the less failures happen on the credit market. Thus the test reveals that in Italy, the extent of redistribution has given rise to more investment opportunities, which is assumed to have enhanced growth. The fact that the results are very unambiguous, grant the models an outstanding evidence of success in depicting the real underlying dynamics.

Another test is conducted to show that equality level in general has positive effects on credit market as well, and they are independent from the development level and the socio-economic situation in general of one country. Hence, the regressions regard US that is one of the member states of OECD, and Brazil that is instead a member of the BRICs. The variables used are again the NPL and this time the level of the country's equality, indicated by the Gini coefficient (GINI).

The regression shows there is a clear positive relation between the Gini coefficient and the rate of non-performing loans in both countries. This is assumed to prove that inequality level has a positive effect on credit market failures, as a rise in GINI means an increase in the inequality level in a certain country.

These countries belonging to so different situation (US is an high income country, while Brazil is a developing country which GINI is constantly above .5 for the entire sample period) confirm the validity of the model, as the relation between the variables is clear and effective. To conclude, although there is consciousness about the scarcity of the observations, it is believed that the collected evidence confirms in full the implications of the models above, that is redistribution of income is an essential element in the understanding of the dynamics of modern economies; and it is firmly thought that hopefully in the future, along with the availability of more data, this will be confirmed.

CONCLUSION

This work stands as an analysis of inequality and income distribution topics, addressed to make possible the acquisition of an overview and a fair comprehension for the reader. The first part of the survey has proposed a review of the principal metrics used by technicians and scholars to measure inequality and collect data and, afterwards, of the literature achievements back a century until nowadays. It has been reported how the view upon the subject has enlarged in time, moving the focus zooming out from within-countries to cross-countries up to global inequality perspective, both from empirical and theoretical point of view. Links have been proposed to explain such a change, most of all globalization and potential social instabilities implications. With regard to empirical applications, methods to gather evidence have passed from relative metrics that focus on income shares, to single indexes capable of reducing complexity, to household surveys that potentially allow for worldwide comparability of data. The discussion is much more complex from the point of view of theoretical literature, as after several theories have tried to give an explanation for the manifold dynamics that inequality carried through the years, still it lacks unanimity upon its functioning. The causes of inequality are not totally clear, as economic and technological development cannot explain it alone (some unequal economies have experienced fast growth while several highly developed countries shows large inequality levels). This work proposes the unconscious research for mere profit as one of the causes, depicted to some extent by the skill-biased orientation of technical change during the last years and by the lack of consideration about the lost investment opportunities of the less wealthy brought by the imperfection of credit markets. Moreover, the relationship between income inequality and economic growth has been interpreted in ambiguous ways; relying on the actual data, it cannot be argued that inequality harms growth, as many developed countries show quite high inequality levels. What is argued here is that equality, reached through redistribution and apart from the obvious social and ethic positive considerations, can actually be growth enhancing. In this sense, in the second part of the survey two models are presented, chosen among the many because of their consideration for the imperfection of capital markets and the positive impact of redistribution. The important conclusions that can be extracted from such theoretical models are essentially two. First, caring about the less wealthy and redistributing towards those whose marginal productivity of investments is higher, produces opportunities of growth. Second, such a redistribution has positive incentive effects. When we consider the realistic situation of capital markets being imperfect and carrying moral hazard jeopardies, rendering the poor a bit richer, while not affecting the behavior of the wealthy, would increase their total level of effort in the perspective of investments, and thus would allow the economy for a more inclusive and sustainable growth. In the last section, some

tests have been conducted on various countries to give proof of these models reliability. Gathering national data and investigating on the relation between redistribution (and equality in general) and credit market failures, what results (in the consciousness of the scarcity of the data) is an outstanding evidence in favor of such models. All the coefficients are highly significant and the relation is unambiguously positive, showing that equality has indeed a positive effect on investments outcome. Other notable result Very important, at this point, is to understand that both models are built upon the major assumptions of neoclassical economics, such as decreasing returns to capital, U-shaped average cost curve, utility maximizer individuals and technology productivity denoted by one parameter; and their results emerge brightly. Thus if we continue to rely firmly on this school's principles, then we definitely have to take into account redistribution, for sure preventing to kill the competition, to be able to grow as much as possible all together. A more unified growth is fundamental to be sustainable, we cannot continue to grow regardless of who falls behind because it is a costly issue to maintain for economies; unequal countries must employ resources to restrain crime, poverty and illnesses. Another reason for moving towards a unified growth is that, sooner or later, such a wealth concentration will break democracy pillars such as an equal political representation as well as just laws address. We should exploit redistribution potential to grow equally in such a more and more integrated world we are all inhabitants of.



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Abstract

The topic of inequality is faced from different perspectives in order to allow for a suitable comprehension. Before the theoretical examination, the principal metrics are presented, along with evidence upon the situation in history and in the present. Evolution of measurement methods and theories are tried to be explained, as well as the implication of studying inequality at different levels, in order to clarify the dynamics of inequality both from technical and theoretical points of view. In line with this a possible explanation for the increase of inequality occurred in the last years worldwide is proposed, which finds support in a theoretical framework, which is a composition of two notable models, that is presented. The reasons upon the proposal and the choice of such models are expound together with the presentation of some tests directed to verify the reliability. The results of such tests are reported and analyzed, finding a large evidence upon the implications of the models and on the original proposal.

Inequality and Income Distribution

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1. Introduction

First of all, what exactly does income inequality mean? For long time, it was treated as the dispersion of incomes within a national state and studied to assess the magnitude of poverty among inhabitants and areas of countries. Later on, with the availability of new size and types of data, the argument was faced from a cross-countries perspective. National data were compared in order to locate poverty and wealth concentrations among agglomerates and continents. Something that has been clear since the beginning of the studies, is that there is no point in studying inequality between two groups that do not interact with each other, at least not for anything apart from mere measurement, so attention has been put on analyzing inequality among peer (or reference) groups – i.e. groups of people sharing characteristics such as social and economic status, level of education and ethnic background. Hence a natural question arises, what is a peer group today, and how we deal with that? Of course a globalized world brings some implications; the much increased movement of production factors across borders and the increased influence of other people's standard of living and way of life on our perceived income position and personal aspirations are among the reasons why such a grouping of people, if not removed, has been adapted to the new world dynamics. Along with it, also the topic's address has changed, towards the consideration of inequality among world citizens, or global; and as the world becomes more and more integrated, the global dimension of inequality is likely to become increasingly relevant. Global income inequality is indeed one of the most pressing current problems of our era and the relationship between inequality and growth is probably one of the most important in economics, which moreover has recently acquired added relevance because of the slowdown of growth and simultaneously rising inequality in rich countries. The revealed picture is that income inequality has increased worldwide and particular aspects are highlighted by recent estimates¹. In 2012, 12.8% of world's population, about 900 million people, lived at or below \$1.90 (2011 PPP) a day, which is the 2015 updated international poverty line; and looking at a higher threshold, over 2.1 billion people in the developing world lived on less than \$3.10 a day. If attention is moved to the situation at the upper end of the income distribution, it is reported that almost half of the world's wealth is owned by just one percent of the population. Moreover the wealth of the one percent richest

¹ World Bank Poverty Overview (2015).

people in the world amounts to \$110 trillion, that is 65 times the total wealth of the bottom half of world's population (3.5 billion people), which is the same wealth that is owned by the richest 85 people on the planet². It has been also estimated that within 20 years the world is likely to see its first trillionaire, who will be holding a wealth of \$1000 billion; this is a lot more than almost every African country's GDP, and some European countries as well (think of Lithuania, which is the last country that entered the European Union with a GDP of \$50 billion in 2015). Although poverty and income inequality are often mentioned in the same statement, they are very different concepts; while it is unanimously agreed that poverty is bad, it is less clear that income inequalities are undesirable. Obviously, redistribution has a central role in the whole discussion, and what is to be understood is not so much whether it needs to be applied, as the magnitude of its extent. Some economic inequality is essential to drive growth and progress, rewarding those with talent, skills and the ambition to innovate and take entrepreneurial risks; however, the extreme levels of wealth concentration occurring nowadays threaten to exclude hundreds of millions of people from realizing the benefits of their talents and work. This massive concentration of economic resources in the hands of fewer people presents a significant threat to inclusive political (due to the problematic effect that wealth concentration can have on equal political representation) and economic systems. The danger is that the increasing separation across people by economic and political power could light the fuse of social tensions and breakdown. Economic and technological development are unlikely to be alone the cause of such a wide and rooted inequality, the unrestrained research for mere growth sustained by pure profit oriented policies without much doubts is one. A fundamental remark that has to be made is that, while inequality is also found to affects positively growth, such a positive effect is exclusively reserved to the upper end of the income distribution, which means that the type of growth inequality stimulates is a growth that even more enhances inequality³. In this sense, the scope of the work is to gather evidences, theories and analysis methods that have characterized most the study upon inequality across the years; in the hope that the reader could acquire an overview on the subject that may be sufficient to understand the present inequality dynamics, and how these will evolve in the future. Moreover, there is an attempt to demonstrate the importance of applying redistribution policies as a means to easing within-countries inequality and the relative jeopardy social tensions. In the second

² Credit Suisse, Global Wealth Report (2013).

³ Roy van der Weide and Milanovic (2014).

section the reader finds a concise review of the principal inequality measurement methods and theories that have contributed in interpreting inequality dynamics. In the third section an effective model of endogenous growth and inequality is presented which has the purpose of demonstrate the positive effects of redistribution upon growth and individual wealth, with particular attention in the prevailing circumstance of imperfect capital markets. The fourth section, finally, is dedicated to the research of an empirical evidence upon the results of that model, and in general on the characterization of present inequality situation.

2. Inequality metrics, theories and evidence

2.1 Metrics and evidence

Inequality can be measured in various ways and at several levels. Until the 2000s empirical literature, addressed to the convergence issue, has been concerned on estimating inequality within and among countries and two important properties have been postulated that any measurement method should satisfy in order to enter the class of relative inequality measures. The principle of transfers (also known as the Pigou-Dalton principle) states, in its weak form, that whenever income is transferred from a rich to a poor person while still preserving the order of income ranks, then measured inequality should not increase. In its strong form, measured inequality should even decrease. Scale invariance property, whereby richer economies should not be considered more unequal a priori, is the trait of homogeneity that an income inequality metric should possess: if every income in an economy is multiplied by any positive constant, the overall metric of inequality should not change. In other words, the inequality metric should be independent of the aggregate level of income. Again, there exist many metrics performing the task of measuring income inequality and although they were discovered to behave very similarly and to be highly correlated⁴, each has its peculiarity and fits to specific purposes. Among the most common inequality metrics, the Gini coefficient (Gini 1912) is surely the most frequently used. It is defined mathematically based on the Lorenz curve, which plots the proportion of the total income of the population (y axis) that is cumulatively earned by the bottom x% of the population. The 45 degrees line thus represents perfect equality of incomes and the Gini coefficient is the ratio of the area that lies between the equality line and the Lorenz curve over the total area below the equality line, $G = A/(A + B)$ (chart). If it is assumed that every person in the population has non-negative income it ranges from 0 to 1, where 0 stands for perfect equality – i.e. all individuals earn the same portion of the aggregate income, and 1 for complete inequality – i.e. one individual receives 100% of the total income and the remaining receive none. If instead negative values are possible, such as the negative wealth of heavily indebted or financial distressed people, then the coefficient can

⁴ Kawachi and Kennedy (1997), in their work on the relationship between income inequality and mortality, analyzed six different measures of inequality and found Pearson correlation coefficients ranging from .86 to .99 among them.

theoretically exceed 1. The Gini coefficient varies depending on whether it is calculated on income before or after taxes, of course a calculation based on net income allows to recognize the effect of redistribution. In Italy, for instance, as estimated for the late 2000s by the United Nations Development Programme, the Gini coefficient has decreased from .53, when calculated on gross income, to .33 when redistribution (taxes and transfers) is taken into account. In general a Gini coefficient below .3 is considered to be low, up to .5 normal and above .5 to show high inequality. The ease with which the Gini coefficient computation is understandable and the even more important reduction of complexity following the information reduction brought by the aggregation of an entire distribution into a single index, led to its popularity. Its main disadvantage, by the way, is represented by the fact that it does not capture at what level of the distribution the inequality occurs and it is unable to discern the effects of structural changes in populations, such as baby booms, aging populations, immigration, emigration and income mobility, because it is not decomposable. Also based on the Lorenz curve, maybe the simplest inequality index to calculate and to understand, is the Robin Hood index (also known as the Hoover index), which measures the proportion of the total income in a society that needs to be redistributed to achieve a state of perfect equality. It can be thought of as the amount of resources subtracted from the rich and given to the poor and this is where the name comes from. To state its analytical version assume a system is segmented in an amount N of quantiles, each one with width A_i (the number of individuals in each quantile) and observed income E_i , then E_{tot} is the total income and A_{tot} is the population number of individuals:

$$RH = \frac{1}{2} \sum_{i=1}^N \left| \frac{E_i}{E_{tot}} - \frac{A_i}{A_{tot}} \right|$$

More easily, it can be represented graphically as the maximum vertical distance between the Lorenz curve and the equality line. Another valid summary statistic that is used to measure inequality is the Theil index (Theil, 1967). It is an entropy measure (maximum entropy, which can be thought as maximum disorder, occurs once individuals cannot be distinguished by their income - i.e. when there is perfect equality) varying from 0 to 1; a Theil index of 1 indicates maximum redundancy and so that the distributional entropy of the investigated system is similar to one with an 82:18 distribution (slightly more unequal than in the “80:20 Pareto principle”). The Theil index is:

$$T_T = \frac{1}{N} \sum_{i=1}^N \left(\frac{x_i}{\bar{x}} \cdot \ln \frac{x_i}{\bar{x}} \right)$$

where \bar{x} is the mean of x . If one individual owns all the income, then $T_T = \ln N$, which is maximum order; the normalization of the equation to the range from 0 to 1 is obtained dividing T_T by $\ln N$. The main advantage of the Theil index is that it is decomposable, as it is a weighted average of inequality within subpopulations plus inequality among those; assume the population is divided into m subgroups, let s_i be the income share and \bar{x}_i the average income of group i and let T_{Ti} be the Theil index for that subgroup, the composed Theil index is then:

$$T_T = \sum_{i=1}^m s_i T_{Ti} + \sum_{i=1}^m s_i \ln \frac{\bar{x}_i}{\bar{x}}$$

in such a way that it is possible to control for the singular contribution of the between-group and the within-group component and discriminate over their relative importance on affecting overall inequality. Atkinson (1970) proposed a transformation of this index into what is now known as the Atkinson index. It also has a range between 0 and 1, where 0 indicates perfect equality and 1 maximum inequality, and is useful in determining which end of the distribution contributes most to the observed inequality. It is defined as:

$$A_\varepsilon(y_1, \dots, y_N) = \begin{cases} 1 - \frac{1}{\mu} \left(\frac{1}{N} \sum_{i=1}^N y_i^{1-\varepsilon} \right)^{1/(1-\varepsilon)} & \text{for } 0 \leq \varepsilon \neq 1 \\ 1 - \frac{1}{\mu} \left(\prod_{i=1}^N y_i \right)^{1/N} & \text{for } \varepsilon = 1 \end{cases}$$

where y_i is individual income ($i = 1, 2, \dots, N$) and μ is the mean income. Briefly, the Theil index is turned into a normative measure by imposing a coefficient ε to weight incomes; choosing the weight to be placed on changes in a given portion of the income distribution, the index becomes more sensitive with respect to changes at the lower end of the distribution as ε approaches 1, and to the upper end as it approaches 0. The Atkinson ε parameter is called the “inequality aversion parameter”, since it quantifies the amount of social utility gained from redistribution. For ε equal 0 no social utility is assumed to be gained and the Atkinson index (A_ε) is zero. It is important to remark that all these measures have in common to be summary statistics since they are single indexes enclosing properties of entire distributions, thus the information on the measured inequality is reduced. A weaker reduction of complexity is achieved if income distribution is described by shares of

total income; this is because rather than to indicate a single measure, the investigated system is divided into segments, percentages of the population. Percentage share of national income that accrues to a subpopulation indicated by deciles or quintiles, for instance, is particularly used to measure that fraction of income top or bottom earners account for. In this category, worthy of mention is the 20:20 ratio which assess how much richer the top 20% of people are compared to the bottom 20%. It finds several applications as it can be thoroughly revealing of the actual impact of inequality since it statistically preserves the middle 60% of the population from the effect of outliers at the top and bottom of the distribution. Another common method to look at income shares is represented by the Palma ratio; based on the work of Palma (2011) who found that middle class incomes always account for about half of the gross national income (GNI) and that the other half is split between the richest 10% and poorest 40% (although their shares vary considerably across countries), it is indeed defined as the top 10% of the distribution's share of GNI divided by the bottom 40%'s. The Palma ratio is supposed to address the over-sensibility of the Gini index to variations in the middle of the distribution and its insensibility to variations at the top and bottom and therefore more accurately reflects the impact of income inequality on the society. The Palma ratio is actually used, together with the Gini coefficient and the 20:20 ratio, by the United Nations Development Programme to measure income inequality in almost every country of the world. In the 2015 Human Development Report it is outlined that among the category of "very high human development" countries, the 20:20 ratio varies from as little as 3 or 4 to as much as 10 or 12 with the most equal country being Slovenia (3.6) and the most unequal being Chile (12.6). It is also reported that in the UK the richest 20% individuals are nearly 8 times richer than the bottom 20% and in the US they are about 10 times as rich, with these ratios that have increased in the last decade. In the category of "low human development" the 20:20 ratio exceeds 10 in several countries and in some cases a factor of 20, with the most unequal country being Haiti, where the richest 20% is 26.6 times richer than the bottom 20%. Overall the calculations show that South Africa is one of the most unequal countries with the highest Palma ratio, the 10% richest individuals are 8 times as rich as the bottom 40%, one of the highest 20:20 ratio, the richest 20% are 28.5 times richer than the bottom 20%, and a Gini coefficient of .65. The OECD countries appear to be the most equal, with an average Gini coefficient between .25 and .3 and a Palma ratio up to 2.2, however, the 20:20 ratio exceeds a factor of 6 in some

countries like Spain (7.6), Italy (6.9), Israel (10.3), in addition to the UK and the US (both with Gini coefficient around .4). The OECD countries also appear to be the countries that redistribute more, comparing the Gini coefficient estimations with gross and net income, the result is that redistribution has lowered the measured inequality by an average of 20 percentage points in the last decade. Recently, with the strengthening of phenomena as globalization, migrations and poverty, attention has moved for the empirical literature to the comprehension and the characterization of global inequality, inequality among world citizens. With regard to this question, while some authors have continued to estimate inequality through the mentioned metrics, some others have proposed and promoted new methods, in particularly the use of household surveys, which are supposed to overcome the lack of comparable data that exist for some countries and allows, with due attention to national differences, to compare distant observations⁵. For these reasons, the use of household surveys has overcome most of the other methods, in the perspective of reaching new achievements for the empirical literature, mostly with regard to global inequality, which fail to be represent properly by the standard metrics.

2.2 Major theories

Inequality topic, although relatively recent, has been addressed by many and faced with a variety of perspectives. The starting point is the original intuition, although erroneous, of Pareto (1897), according to which the distribution of income is essentially fixed in time. Half a century later, the interest was revived by Simon Kuznets (1955), who led the first important studies focusing on income inequality and economic development; analyzing cross-country data and time series, he found an inverted U-shaped relation between income inequality and GNP per capita. The *Kuznets hypothesis*⁶ was to link this result to the passage from a rural economy to an industrial one: income inequality should increase during urbanization and industrialization phases and decrease later on when industry attracts the great part of labour force. Empirical evidence was indeed by his side, as the share of total wealth owned by the 10% richest households in US rose for about a hundred years between 1770 and 1870 and receded back during the second half of the 20th century;

⁵ Milanovic (2006), Atkinson and Brandolini (2004).

⁶ Kuznets (1955) and (1963).

and a similar situation made it seem possible to apply the same hypothesis to most of the OECD countries. However this trend has reversed by the end of the century, and income inequality has kept rising during the recent decades, stimulating new studies and theories. The 1990s, with the development of endogenous growth theory together with the availability of comparable data for a large cross-section of countries, have seen the literature focusing on the impact of inequality on growth. The majority of the studies carried in those years suggests that greater inequality reduces the rate of growth in a very unambiguous way⁷. The average rate of growth of per capita GDP over the period 1960-85 has been regressed onto a set of explanatory variables, using income inequality as a proxy for wealth inequality; the result was that inequality determines physical and human capital investment, which in turns affects the long run growth rate. The distribution of wealth has been proxied by the distribution of land; in both cases estimations of the Gini coefficient showed a negative impact on growth. The average rate of growth for the same period was also regressed on the income share accruing to the third quintile of the income distribution for large cross-section of developed and developing countries; representing the income distribution of the middle class, and thus considered a measure of equality in the underlying distribution, its impact on growth is positive, significant and robust to the introduction of other explanatory variable. An additional peculiarity of the period was for the empirical literature to provide insights over the channels through which inequality affects growth. Some authors highlighted the role of credit constraints and found that greater credit availability has a positive effect on the growth rate and the impact increases as the income share of the lowest two quintiles decreases, hence as inequality rises. Some others have put forward the role of macroeconomic volatility; measured by the standard deviation of GDP growth, it appeared to consistently reduce the growth rate as it discourages investments⁸. Examining the impact of fiscal policy, Easterly and Rebelo (1993) and Perotti (1996) found that redistribution, measured by the marginal tax rate and different types of social spending, has a positive effect on growth. All of this results clash with the traditional view of economic theory that there is a fundamental trade-off between productive efficiency and social justice, that inequality is growth enhancing and hence that redistribution is harmful for growth. This concept is founded on three main thesis; first comes Kaldor's hypothesis that inequality positively affects growth because of the higher marginal propensity to save

⁷ Alesina and Rodrick (1994), Perotti (1992,1993,1996), and Persson and Tabellini (1994).

⁸ Perotti (1992), Breen and García-Peñalosa (1998).

of the rich with respect to the poor, if the growth rate of GDP is related to the proportion of national income that is saved, more unequal economies would grow faster⁹. This was actually formalized by Bourguignon (1981) in a Solow model where he showed that with a convex savings function, aggregate output does depend on the initial distribution and its level is higher along the more unequal steady state. A second reason has to do with investments indivisibilities: investments projects, particularly the implementation of innovations and the creation of new industries, are often characterized by large sunk costs; hence wealth needs to be sufficiently concentrated in order to allow some individual to cover them. The third is based on incentive considerations, due to Mirrlees (1971), who considered a moral hazard context in which output depends on unobservable effort; rewarding individuals with the same constant wage, independently from the (observable) performance would deter them from investing any effort. Summarizing, on one side redistribution reduces differences in income and hence lowers the rate of growth, on the other, as it is financed by income taxation, diminishes the incentives to accumulate wealth; thus the incentive effect of redistribution should always be negative. Overall, the empirical results contrast this vision and a possible explanation is based on the median voter hypothesis, according to which, when individuals are ordered by their factor income (i.e. income before taxes and transfers), the median voter (i.e. the individual with the median level of income) will be relatively poor in unequal societies. His income will be low in relation to the mean and if net transfers are progressive, she has more to gain from transfers than she would pay in taxes. This means that if inequality determines the extent of redistribution, more voters in unequal societies are expected to prefer high redistribution; so if redistribution reduces the incentives to invest, and hence the growth rate, then more equal societies would grow faster. The median voter hypothesis has been tested and found support from several authors¹⁰. More recently, studies have moved from inequality among countries to inequality between world individuals, what Milanovic (2005) calls global or Concept 3 inequality. This concern is of course due to globalization, deindustrialization and physical and human capital mobility. Sala-i-Martin (2002) estimated global income inequality using popular indexes such as the Gini coefficient, the variance of log-income, the Atkinson index and the Theil index, using GDP and within-country income shares data for the period 1970-1998 to calculate . All indexes show an increase in within-country

⁹ Kaldor (1955).

¹⁰ Alesina and Rodrik (1994), Persson and Tabellini (1994), Milanovic (1999).

disparities during the sample period, but not enough to offset the reduction in cross-country disparities. This was largely attributed to the high growth rate of the incomes of the 1.2 billion Chinese citizens, and the author estimated that unless Africa starts growing, then China, India, the OECD and the rest of middle-income and rich countries will diverge away from it, and global inequality will rise again. Milanovic (2013) calculated global inequality using household surveys for the period 1988-2008. He define global inequality (Concept 3 inequality) as being “*the most important concept for those interested in the world as composed of individuals, not nations*” and composed of population-weighted international inequality (Concept 2 inequality) and inequality due to income differences within countries. The relationship is shown for Gini and Theil coefficients as:

$$Concept_3_Gini = \sum_{i=1}^n G_i p_i \pi_i + \frac{1}{\mu} \sum_i^n \sum_{j>i}^n (y_j - y_i) p_i p_j + L$$

$$Concept_3_Theil = \sum_{i=1}^n p_i T_i + \sum_{i=1}^n \left(p_i \frac{y_i}{\mu} \right) \ln \frac{y_i}{\mu}$$

where y_i is the i -th country’s per capita income, μ is the mean income, p_i is the population share of i -th country in total world population, π_i is the share of i -th country in total global income, n is the number of countries, G_i and T_i are respectively the Gini and the Theil coefficients of national income distribution, L is the overlapping component and the second addendum is respectively the Concept 2 Gini and the Concept 2 Theil. Since the latter are by far the larger components, accounting for between 2/3 and 3/4 of global inequality (depending on the chosen inequality metric), Concept 2 inequality can be used as a lower bound proxy to global inequality. When it comes to computation, he remarks the fact that income needs to be adjusted using country’s relative price level, that is to use PPP (purchasing power parity) exchange rates to translate domestic currencies into international dollars. Relatively to this, the concern is that relative prices faced by different segments of the income distribution are not the same, for instance, relative food prices faced by the poor in poor countries are higher than what is implied by the use of a single PPP¹¹. Following his calculations, the results confirm that there was a decrease in global inequality, actually the first since the Industrial Revolution, though it can be sustained only if countries’ mean incomes continue to converge. Apart from the empirical literature, some results came from the theoretical literature as well. One of the key points of the recent debate is the role of the

¹¹ Pogge and Reddy (2003).

labour market's dynamics and the technological change in explaining inequality. Acemoglu (2002) argued that the income inequality increase (within countries) during the last decades of the twentieth century was due to technological change, in particular to the fact that technological change has been skill-biased for most of the century and it has accelerated up to the early 2000s¹². A skill-bias is basically a shift in the production technology that favours skilled over unskilled labour by increasing its relative productivity and, therefore, its relative demand. According to the author, this is recognizable by the behaviour of wages and returns to schooling. In the US inequality started to increase in the early 1980s as the college wage premium rose sharply, being one of the major motivating facts for the empirical inequality literature. Moreover, median wages stagnated in the same period and onwards while workers at the 10th percentile of the distribution (low-skilled) saw their earnings fall in real terms, even below the levels of a couple of decades before. The high level of schooling premium is the reason for the increase in the demand for skills and the acceleration in skill-biased technological change is then likely to have been a response to the resulting wide supply of skills. Although a tendency towards greater inequality has been a common feature in more and less developed countries, there are also marked differences in the within- and between-group inequality behaviour across them. As a matter of fact, while income inequality increased substantially in the UK and the US, it remained more stable in many continental European economies¹³. An estimable explanation for this divergent behaviour is summarized by Krugman (1994); sometimes referred to as the Krugman hypothesis, it states that inequality did not increase as much in Europe because, there, labour market institutions have encouraged wage compression, limiting the extent of inequality. To formalize this it is useful to start from a theoretical framework¹⁴ in which inequality and returns are determined by supply and demand forces, and firms operate exclusively along their relative demand curve, suppose there live $L(t)$ low-education (unskilled) workers and $H(t)$ high-education (skilled) workers, inelastically supplying labour at time t , all being risk neutral and labour income maximizers. The production function for the aggregate economy takes a constant elasticity of substitution form of the type:

$$Y(t) = \left[(A_l(t)L(t))^p + (A_h(t)H(t))^p \right]^{1/p}$$

¹² Gottschalk (1997), Krueger (1998), Katz and Autor (2000).

¹³ Davis (1995), Gottschalk and Smeeding (1999).

¹⁴ Acemoglu (2002).

where $p \leq 1$, $A_l(t)$ and $A_h(t)$ are factor-augmenting technology terms and the elasticity of substitution between skilled and unskilled labour is $\sigma \equiv 1/(1 - p)$. Workers are referred to as gross substitutes when $\sigma > 1$ (or $p > 0$) and gross complements when $\sigma < 1$ (or $p < 0$), while as $\sigma \rightarrow 1$ the production function tends to the Cobb Douglas case. Now, assuming that labour market institutions impose an exogenous skill premium $\bar{\omega} = w_h/w_l$ to control the wage compression, implies:

$$\frac{H}{l} = \left(\frac{A_h}{A_l}\right)^{p/(1-p)} \bar{\omega}^{-1/(1-p)}$$

where the level of employment of unskilled workers, l , will generally be less than their labour supply L because of wage compression. Very important to remark is that, the more compressed the wage structure gets –i.e. the lower $\bar{\omega}$, the more the unemployment of unskilled workers, given by $L - l$, will increase. In other words, lowering the schooling premium would defer more people from getting skilled with this resulting in an augmented number of unskilled workers, meanwhile lowering their probability of being hired. Evidence was actually find, suggesting that minimum wage, strong unions and generous transfer programs in Europe were in part responsible for the relative wage compression¹⁵. But this hypothesis has received some criticisms as well, in particular with regard to the prediction that profit maximizing employment decisions of firms should lead to a decline in the employment of unskilled workers, yet, in Europe, the unemployment rates of skilled and unskilled workers rose together. This may in part be due to the possibility for always faster skill-biased technological changes to decrease the employment rate of “out to date” skilled workers. Although this is a possibility, and deviations from the model above are in theory eligible due to bargaining arrangements between firms and unions, there still be lack of direct evidence on how far European economies may be off the relative demand curves. A considerable part of theoretical literature has focused on the effects of inequality and redistribution on growth. One building block of neoclassical economics is the assumption that there are diminishing returns to capital, and it is precisely this assumption that drives the familiar convergence results both at cross-country level - as in the Solow model - and for individuals, although these results rely strongly on the existence of perfect capital markets. It is a well known fact that this last assumption fails almost always in depicting the real situation and as Stiglitz (1969) first pointed out, when capital markets are

¹⁵ Blau and Kahn (1995).

imperfect, and returns to capital are decreasing, individual wealth does not converge to a common value and aggregate output may be affected by its distribution among individuals. Following the standard growth model, he assumes that total output is produced by the aggregate stock of capital, that is $y_t = f(k_t)$; when individuals are limited in their borrowing capability, wealth distribution affects their production possibility. This results in a negative impact on the aggregate output level and also, in an endogenous growth model, on the rate of growth. Galor and Zeira (1993) put forward an influential model of endogenous growth with an extreme form of capital market imperfection: there is simply no consideration for the credit market, as any possibility of borrowing and lending is assumed away. Also, aggregate output is the sum of output generated by each individual's production – i.e. $y_t = \sum_i y_{i,t} = \sum_i f(k_{i,t})$; it is shown that when individual production functions are concave, greater inequality results in a lower rate of growth. Due to decreasing returns to individual capital investments, the rich have a relatively low marginal productivity of investments, while the poor have a relatively high marginal productivity of investment, though they are limited in investing at most up to their endowments. Then a redistribution of wealth from the rich to the poor would have an enhancing effect on aggregate productivity and hence on growth. Redistribution creates investment opportunities in the absence of perfect, or at least well-functioning, capital markets. The question of inequality is still an open subject and economic theory must continue to take into account new evidence coming from the so many studies carried out worldwide. In the next section a model is presented, which is focused on recognize the opportunity enhancing as well as the positive incentive effects of redistribution.

3. A model of inequality and growth

In the context of the analysis on the effects of inequality on growth it is essential to consider the role of redistribution, since, as in Galor and Zeira (1993), it is unlikely for an economy to start with equal conditions among individuals and the initial distribution of wealth, determining the investment in education and bequests to the offspring, in turn affects both aggregate output and the long-run distribution of wealth and skills. To clarify, there is no attempt aimed at asserting that inequality is harmful for economic growth itself – although it may be argued that it is in regard to social and ethical aspects – because it is not so. There is just the one of try to prove that growth may be improved moving towards more equal systems. Hence, the reason why the two following models have been chosen to render in a theoretical framework the income inequality issue, and most of all its relationship with growth; is because of their consideration for heterogeneous individuals and credit market imperfections, which is here assumed to truthful represent the actual situation of economies, within a model that accounts for the most relevant assumption characterizing neoclassical economics.

3.1 Bénabou endogenous growth model

In line with this, the particular formulation which is used is a theoretical model formalized by Bénabou (1996) which draws its foundations from some underlying ideas behind the work of Galor and Zeira such as learning by doing and knowledge spillovers. The former is the property for individuals of learning the more, the more they produce in a certain period, hence heightening the overall level of knowledge available in the next period. The presence of knowledge spillovers implies that the learning accomplished by an individual increases the knowledge of all other individuals and thus the general technology level. The level of technology is thus endogenous exactly because of this two elements. The starting point is an endogenous growth framework in which externalities in capital (physical and human) accumulation drive growth; individual production generates spillovers and this implies that individual production functions differ from the aggregate one. Formally, individual i production at time t , resulting from an invested capital $k_{i,t}$, takes place according to the technology

$$y_{i,t} = A_t k_{i,t}^\alpha$$

with $0 < \alpha < 1$ and A_t being the level of technical knowledge, or human capital, available at time t and common to all individuals. The assumptions of learning by doing and knowledge spillovers are captured by the fact that the accumulation of knowledge results from the past aggregate production, that is

$$A_t = \int y_{i,t-1} di = y_{t-1}.$$

Because of learning by doing, growth depends on individual investments and the rate of growth is then:

$$g_t = \ln \left(\frac{y_t}{y_{t-1}} \right)$$

that is

$$g_t = \ln \left(\frac{\int A_t k_{i,t}^\alpha di}{A_t} \right) = \ln \int k_{i,t}^\alpha di$$

and then, it can be expressed simply as

$$g_t = \ln E_t [k_{i,t}^\alpha].$$

Namely, the rate of growth depends on the distribution of capital investments among individuals; hence, it is now necessary to characterize investments and investigate over their determinants. Assume that, in an economy with just one good (serving both as capital and consumption good), there is a continuum of over-lapping generations. Such OLG framework defines a *general economy* - i.e. an economy with an infinite number of two-period lived individuals – in which the utility of an individual i born at time t is given by

$$U_i^t = \log c_{i,t}^t + \beta \log c_{i,t+1}^t$$

where $c_{i,t}^t$ and $c_{i,t+1}^t$ denote current and future consumption and $\beta \in (0,1)$ is a time discount rate. Individuals differ in their initial endowments which, in order to simplify the model abstracting from intergenerational transfers and bequest decisions, are assumed to be determined randomly at birth. Let the endowment generated upon birth of an individual i born at time t be

$$w_{i,t} = a \cdot \varepsilon_{i,t}$$

where a is a constant and $\varepsilon_{i,t}$ is an identically and independently distributed (*iid*) random variable with mean $\frac{1}{a}$. Of course an individual can choose either to consume her endowment or to invest it in the production of the next period consumption good. Focusing on the

implications consequent the nature of capital markets, a first result is that, with perfect capital markets, all individuals will choose to invest the same amount of capital $k_{i,t} = k_t^*$, no matter the initial disposal of wealth among them. The reason is that the opportunity cost of investing is the same for lenders and for borrowers, it is just the interest rate; so everybody in the economy wants to invest up to the point in which this one is equal to the marginal product of capital. In the specific, those whose wealth is above such level lend and those whose wealth is below it borrow. Hence, in the case of perfect capital markets, the distribution of wealth does not affect aggregate output nor growth. However, as stated above, the interest is in the results of a model whom takes into account capital market imperfections, which is a more realistic situation. As argued by Aghion, Caroli and García-Peñalosa (1999), when capital market imperfections pour in a scarce and costly credit, equilibrium investments under laissez-faire will remain unequal across individuals with heterogeneous endowments. To better formalize the concept, attention has been again paid to the dynamics of a framework representing the extreme situation of borrowing and lending being completely unavailable, such that in their investment decisions, agents are here constrained by their wealth, i.e. $k_{i,t} \leq w_{i,t}$. It follows that individual investments are simply a constant fraction of their endowment, i.e. $k_{i,t} = s \cdot w_{i,t}$. Thus, in contrast with the case of perfect capital markets, when credit is unavailable equilibrium investments will differ among individuals, being an increasing function of their initial endowments in human capital. In this case, individual output is

$$y_{i,t} = (s \cdot w_{i,t})^\alpha$$

and the rate of growth, dependent upon the distribution of wealth, is

$$g_t = \alpha \ln s + \ln \int w_{i,t}^\alpha di.$$

Those specifications stated, it is now possible to investigate whether more inequality has a positive or negative effect on growth. Following a standard result in expected utility theory¹⁶, the assumption of decreasing returns with respect to individual capital investments k_i – i.e. the fact that $\alpha < 1$ and, therefore, that the production function $f(k_i)$ is concave –

¹⁶ Given two random variables X and Y, where Y is obtained from X through a series of mean-preserving spreads (a change from one probability distribution to another, where the latter is formed by spreading out one or more portions of the former's probability density function while leaving the mean unchanged). If the utility function (u) is concave, expected utilities are such that $Eu(Y) \leq Eu(X)$. Then, since the expectation over $w_{i,t}^\alpha$ depends on the density function over individual endowments $f_t(w)$, the growth rate is reduced by a mean-preserving spread.

makes it for a larger inequality across individuals, with a given level of aggregate capital stock, to reduce total output. Therefore, the more unequal the distribution of individual endowments, the lower the investments and hence the lower the growth rate of the economy. There is now a need to verify the role of suitable redistribution policies and, in particular, if they may have an enhancing effect on productive efficiency and growth. Consider then a simple ex-ante redistribution of wealth, consisting in the direct taxation (through a lump sum tax) of high endowments and in the consequent subsidy to less endowed individuals using the revenues from that tax. The after-tax endowment of individual i can be defined by

$$\widehat{w}_{i,t} = w_{i,t} + \tau(\bar{w}_t - w_{i,t})$$

where \bar{w}_t is the average endowment and $\tau \in (0,1)$. Those with above average wealth ($\bar{w}_t - w_{i,t} < 0$) pay a tax equal to $\tau(w_{i,t} - \bar{w}_t)$, while those with below average wealth ($\bar{w}_t - w_{i,t} > 0$) receive a net subsidy equal to $\tau(\bar{w}_t - w_{i,t})$. Notice that as a lump sum tax, it does not change the returns to the capital investment; it only influences the incentive to invest insofar as it modifies the available wealth of the individual. As the tax rate τ increases, that is as the distribution of disposable endowments becomes more equal among the agents, the poor (low endowment) will invest more while the rich (high endowment) will invest less. However, recalling that the production technology exhibits diminishing returns to individual capital investments, the overall effect of such a redistribution on total output and on growth, is expected to be positive. This is clearly due to the higher marginal returns to investment of less endowed individuals with respect to the ones with an higher endowment. The mechanism is not complicated: the poorly endowed, who, until the redistribution is put on place, have underinvested because of their economic situation, may now start to invest and, most important, they do so being figuratively on the steeper part of the capital investment curve. Prosecuting on that curve, for higher levels of invested capital, the productivity corresponding to such investments becomes increasingly lower and this is why the augmented possibilities of the poor are expected to move the overall effect toward positive levels. This result may be shown analytically, in fact the rate of growth is now described by

$$g = \alpha \ln s + \ln \int [w_{i,t} + \tau(\bar{w}_t - w_{i,t})]^\alpha di.$$

Considering the term which is to be integrated, as τ increases, the homogeneity among individual investments increases, hence lowering the total efficiency loss due to the unequal distribution of w_i . When the extent of redistribution is maximum, that is when $\tau = 1$, that term is constant $\forall i$ and the highest possible growth rate is achieved. To conclude, when credit is unavailable, redistributing to the poor – those who show the highest marginal return to investment – is growth enhancing; and remarkable is that this *opportunity creation effect* of redistribution still remains when the poor invest all their initial endowment rather than maximize an intertemporal utility as in the case above, as well as when others are the sources of capital market imperfections, such as moral hazard or repayment enforcement problems.

3.2 Aghion and Bolton inequality and growth extension

In order to challenge the traditional view and especially the Mirrlees hypothesis of redistribution having always negative incentive effects, Aghion and Bolton (1997) introduced moral-hazard considerations as the source of capital market imperfections in a framework similar to the one above. Here the cause of moral hazard is the limitation of liabilities, namely the sum that a borrower owes to the lender cannot exceed her own wealth. To easily depict the concept, consider the limit case of an individual with zero wealth who needs to borrow to invest in a risky project, whom probability of success is assumed to depend on the – somehow costly – effort the individual exerts. If the project succeeds, the individual earns the output minus the borrowed amount, while if it fails she incurs no loss since she has not invested own funds. Therefore, the optimal amount of effort exerted by the borrower would be less than what the lender expects. The more an individual needs to borrow, the larger the fraction of marginal return she has to cede to the lender, hence the less incentives she has in endeavouring. In other words, because the effort supply is decreasing in the amount borrowed, the repayment must be proportionate to ensure that the lender obtains the same expected reimbursement. The poorer the borrower, the higher would be her repayment to compensate for a lower probability of paying back. Then it can be already stated that a redistribution toward borrowers would have a positive incentive effect on their effort supply; as long as this incentive more than compensates the consequent negative effects on lending, then such a redistribution would be growth

enhancing relying on incentive considerations. Formally, assuming again an OLG structure though this time indexed by $i \in [0,1]$, and assuming individuals consume only when old, each of them has to exert some effort when young – investing her unit of labour in some entrepreneurial activity – in order to be able to consume in the next period. The individual i 's utility in generation t is then

$$U_i^t = c_{i,t+1} - h(e_{i,t})$$

where $c_{i,t+1}$ denotes individual i 's consumption when old and $e_{i,t}$ is her effort when young with

$$h(e_{i,t}) = \frac{A_t e_{i,t}^2}{2}$$

defining the cost of effort, that is here assumed to be non monetary, and with A_t still measuring the productivity of the technology. Endowment is defined as an idiosyncratic (specific for each individual) fraction of the average knowledge level in a certain date t , and thus unequal between individuals, by

$$w_{i,t} = \varepsilon_{i,t} \cdot A_t.$$

The production activity requires a fixed initial capital outlay equal to

$$k_{i,t} = \varphi \cdot A_t$$

and, conditional upon this requirement being satisfied at time t , the revenue from the investment in the self-employment project is uncertain and given by

$$y_{i,t+1} = \begin{cases} \theta \cdot A_t & \text{with probability } e_{i,t} \\ 0 & \text{with probability } 1 - e_{i,t} \end{cases}$$

where the term $\theta \cdot A_t$ simply denote a fraction of the technology productivity parameter and the second period outcomes $y_{i,t+1}$ are assumed to be *iid* among individuals belonging to the same generation. It is at this point that the moral hazard issue due to the limited liability constraint steps in; specifically the problem is, first, that the effort e_i is unobservable and second, that the repayment cannot exceed the second period output of the borrower $y_{i,t+1}$. Consequently, the concern moves to the analysis of effort dynamics; how is the effort decision influenced by the wealth distribution? An individual who has an endowment such that $w_{i,t} \geq \varphi A_t$ does not need to borrow; consider her decision problem

$$\max_e \left\{ e_t \cdot \theta A_t - A_t \frac{e_t^2}{2} \right\}$$

which, following from the first order conditions, gives the first-best level of effort, $e^* = \theta$. On the other side, an agent with initial endowment $w_{i,t} \leq \varphi A_t$ needs to borrow precisely an amount $b_{i,t} = \varphi A_t - w_{i,t}$ to be able to invest in the high yield project; consider now her problem, in which she has to maximize the expected second period outcome after the pay back and the effort cost,

$$\max_e \left\{ e_t [\theta A_t - r(\varphi A_t - \varepsilon_t A_t)] - A_t \frac{e_t^2}{2} \right\}$$

where r denotes the unit repayment rate. The resulting optimal effort is thus

$$e(r, w_t) = \theta - r \left(\varphi - \frac{w_t}{A_t} \right)$$

which is lower than the first best effort e^* , since $\varphi - \frac{w_t}{A_t} \geq 0$, and is increasing in w_t and decreasing in r . This means that for a given interest rate, the lower the individual's initial wealth, the less effort she would exert in the investment project, lowering its probability of success. It is important to remark that, individuals with wealth $w_{i,t} \geq \varphi A_t$ – the lenders – will systematically exert the first best level of effort, because they are the only claimants on all the revenues resulting from that effort. Moreover, although the repayment rate r is assumed constant in the formalization above, it actually may vary with w because the default risk increases with the size of the loan, in such a way that movements of r reflect changes in the default risk; however Aghion and Bolton (1997) have shown that, even when the repayment rate is free to fluctuate, effort is still increasing in the endowment.

The growth rate of the economy, as in the previous section, is

$$g_t = \ln \left(\frac{y_t}{y_{t-1}} \right)$$

and assuming again learning by doing – i.e. $A_t = y_{t-1}$ – it can be expressed as

$$g_t = \ln \left(\frac{\int e_i \cdot \theta A_t di}{A_t} \right) = \ln \theta + \ln \int e_i di$$

where $e_i \leq \theta$. If assumption of moral hazard is violated, that is if capital markets are perfect, every individual in the economy would exert the first best level of effort e^* , the distribution of wealth would be irrelevant and the rate of growth would simply be $g = \ln \theta^2$. When instead the presence of incentive problems makes the capital markets imperfect, a larger inequality (larger number of individuals with original wealth below the threshold φA_t) would result in a lower aggregate level of effort and thus it would

negatively affect both income and growth. Lastly, moving to the analysis of redistribution, taxing the above-threshold endowed individuals – i.e. the lenders – through a lump sum tax $\tau_i < w_{i,t} - \varphi A_t$ and distributing the proceeds among the borrowers would not affect the first best effort supplied by the lenders, whose after-tax endowment remain strictly above φA_t and it would increase the effort supplied by the less wealthy. Hence a redistribution of this type would have positive incentive effects on output and growth, though the question about its self-sustaining received a negative answer, as argued by the authors; redistribution policies must be sustained over time to have long-lasting effects on output.

4. Empirical results

Economic models are created with the scope of representing specific dynamics happening in the real world and when they are well designed, it is to some extent possible analyzing similar situations relying on them and predict future occurrences. Though a common trend regarding theoretical literature about inequality is that, for so many formalized models, few are accompanied by empirical evidence. Even if a model seems to fit the real dynamics, it is essential to find proofs that it actually does, trying to find some empirical evidence. Hopefully, this is the extent here; although the available data on the inequality topic are still scarce. The test is thus accomplished for a selection of countries among the few high quality data are available for. According to the above modeling, redistribution has two notable implications, which are positive incentive and opportunity creation effects. In order to find evidence to support these conclusions, a test is realized to verify whether those may actually summarize a real situation. Following the second part of the model, a clear result is that redistributing in favor of less wealthy people does produce a positive boost for their effort incentives. In other words, an equal economy allows for more borrowers to succeed in their investment projects. The idea behind the test is to investigate whether redistribution policies effectively makes the credit market more robust, shrinking the amplitude of moral hazard implications, studying the correlation between redistribution and credit market failures. This is put into practice using the banking sector variable of non-performing loans to total gross loans rate (NPL)¹⁷ as a proxy for the magnitude of credit channel troubles, and regressing it onto the difference between the Gini coefficient calculated on disposable income after taxes and social transfers (pensions included) (RED) and the Gini coefficient calculated on market income (this is done to give redistribution a nonnegative dimension), which is a proxy for the redistribution extent. Both variables are reported at annually frequency, *Table 1* shows the results for Italy.

$$NPL(ITA) = \beta_0 + \beta_1 RED(ITA)$$

¹⁷ The bank non-performing loans to total gross loans (as reported in the World Bank specification) variable is the value of nonperforming loans divided by the total value of the loan portfolio (including nonperforming loans before the deduction of specific loan-loss provisions). The loan amount recorded as nonperforming should be the gross value of the loan as recorded on the balance sheet, not just the amount that is overdue.

TABLE 1
THE EFFECT OF REDISTRIBUTION ON CREDIT MARKET

dependent variable	NPL
regressor coefficient	-6,7885
p-value	0,0018*
R squared	0,6781
confidence interval	99%
observations	11

Note: this table reports the regression of the non-performing loans to total gross loans rate on the difference between the Gini coeff. calculated on market income and the Gini coeff. calculated on disposable income after taxes and social transfers (pensions included) for Italy. The reference period is 2004-2014. Source: World Bank, Eurostat.

The regression shows a definitively negative relation between the two variables which is assumed to mean that redistribution has a positive effect on the reduction of the failures of the credit market; namely an increase of the redistribution extent results in a decrease of the non-performing loans rate. In other words, the more equal a country's income distribution is, the less failures happen on the credit market. Note that the coefficient is highly significant at 1% confidence level and the R squared indicates that more than 60% of the variation of the non-performing loans rate is explained by the extent of redistribution. Thus the test reveals that in Italy, the extent of redistribution has given rise to more investment opportunities, which is assumed to have enhanced growth. The fact that the results are very unambiguous, grant the models an outstanding evidence of success in depicting the real underlying dynamics. Another test is conducted to show that equality level in general has positive effects on credit market as well, and they are independent from the development level and the socio-economic situation in general of one country. Hence, the regressions regard US that is one of the member states of OECD, and Brazil that is instead a member of the BRICs. The variables used are again the NPL and this time the level of the country's equality, indicated by the Gini coefficient (GINI). Both variables are reported for annually for each country, *Table 2* shows the results of the test.

$$NPL(US) = \beta_0 + \beta_1 GINI(US)$$

$$NPL(BRA) = \beta_0 + \beta_1 GINI(BRA)$$

country	US	Brazil
dependent variable	NPL	NPL
regressor coefficient	0,3404	0,5918
p-value	0,0033*	0,0039*
R squared	0,4973	0,4838
confidence interval	99%	99%
observations	15	15

Note: this table reports the regression of the non-performing loans to total gross loans rate on the Gini coefficient calculated on market income for US and Brazil. The reference period is 1998-2013. Source: World Bank.

The regression shows there is a clear positive relation between the Gini coefficient and the rate of non-performing loans in both countries. This is assumed to prove that inequality level has a positive effect on credit market failures, as a rise in GINI means an increase in the inequality level in a certain country. The coefficients are both positive and highly significant at 1% confidence level and the R squared indicates that almost 50% of the variation in the NPL rate are explained by changes in the equality level in both countries. These countries belonging to so different situation (US is an high income country, while Brazil is a developing country which GINI is constantly above .5 for the entire sample period) confirm the validity of the model, as the relation between the variables is clear and effective. To conclude, although there is consciousness about the scarcity of the observations, it is believed that the collected evidence confirms in full the implications of the models above, that is redistribution of income is an essential element in the understanding of the dynamics of modern economies; and it is firmly thought that hopefully in the future, along with the availability of more data, this will be confirmed.

5. Conclusion

This work stands as an analysis of inequality and income distribution topics, addressed to make possible the acquisition of an overview and a fair comprehension for the reader. The first part of the survey has proposed a review of the principal metrics used by technicians and scholars to measure inequality and collect data and, afterwards, of the literature achievements back a century until nowadays. It has been reported how the view upon the subject has enlarged in time, moving the focus zooming out from within-countries to cross-countries up to global inequality perspective, both from empirical and theoretical point of view. Links have been proposed to explain such a change, most of all globalization and potential social instabilities implications. With regard to empirical applications, methods to gather evidence have passed from relative metrics that focus on income shares, to single indexes capable of reducing complexity, to household surveys that potentially allow for worldwide comparability of data. The discussion is much more complex from the point of view of theoretical literature, as after several theories have tried to give an explanation for the manifold dynamics that inequality carried through the years, still it lacks unanimity upon its functioning. The causes of inequality are not totally clear, as economic and technological development cannot explain it alone (some unequal economies have experienced fast growth while several highly developed countries shows large inequality levels). This work proposes the unconscious research for mere profit as one of the causes, depicted to some extent by the skill-biased orientation of technical change during the last years and by the lack of consideration about the lost investment opportunities of the less wealthy brought by the imperfection of credit markets. Moreover, the relationship between income inequality and economic growth has been interpreted in ambiguous ways; relying on the actual data, it cannot be argued that inequality harms growth, as many developed countries show quite high inequality levels. What is argued here is that equality, reached through redistribution and apart from the obvious social and ethic positive considerations, can actually be growth enhancing. In this sense, in the second part of the survey two models are presented, chosen among the many because of their consideration for the imperfection of capital markets and the positive impact of redistribution. The important conclusions that can be extracted from such theoretical models are essentially two. First, caring about the less wealthy and redistributing towards those whose marginal productivity of investments is

higher, produces opportunities of growth. Second, such a redistribution has positive incentive effects. When we consider the realistic situation of capital markets being imperfect and carrying moral hazard jeopardies, rendering the poor a bit richer, while not affecting the behavior of the wealthy, would increase their total level of effort in the perspective of investments, and thus would allow the economy for a more inclusive and sustainable growth. In the last section, some tests have been conducted on various countries to give proof of these models reliability. Gathering national data and investigating on the relation between redistribution (and equality in general) and credit market failures, what results (in the consciousness of the scarcity of the data) is an outstanding evidence in favor of such models. All the coefficients are highly significant and the relation is unambiguously positive, showing that equality has indeed a positive effect on investments outcome. Other notable result Very important, at this point, is to understand that both models are built upon the major assumptions of neoclassical economics, such as decreasing returns to capital, U-shaped average cost curve, utility maximizer individuals and technology productivity denoted by one parameter; and their results emerge brightly. Thus if we continue to rely firmly on this school's principles, then we definitely have to take into account redistribution, for sure preventing to kill the competition, to be able to grow as much as possible all together. A more unified growth is fundamental to be sustainable, we cannot continue to grow regardless of who falls behind because it is a costly issue to maintain for economies; unequal countries must employ resources to restrain crime, poverty and illnesses. Another reason for moving towards a unified growth is that, sooner or later, such a wealth concentration will break democracy pillars such as an equal political representation as well as just laws address. We should exploit redistribution potential to grow equally in such a more and more integrated world we are all inhabitants of.

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