Inequality and Growth Revisited

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Abstract

In recent years, a vast literature on the links between inequality and growth has flourished. The emerging consensus is that equality enhances growth, but disagreement exists on the underlying mechanisms. In this paper, we aim to provide the reader with new empirical evidence from a cross sectional analysis of countries. First, we try to improve upon the accuracy of previous empirical models by using new data on inequality extracted from Deininger and Squire (1996). Second, we test alternative specifications of the relationship between growth, redistribution and inequality. Third, we test the relevance of the theoretical models proposed in the literature to explain the inequality-growth relationship.

Results suggest that first, the link between inequality and growth is robust to measurement errors in inequality. Second, the fertility-education issue is the main explanatory factor of the link. Third, we find a non-linear relationship between inequality, redistribution and growth, which tends to confirm Bénabou's model (1996). However, there is also evidence to support an alternative explanation, in which there is reverse causality between redistribution and inequality: accordingly, countries would be considered unequal *because* of their weak redistributive policies.

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Section I – Introduction

In recent years, a vast literature on the links between inequality and growth has flourished. Rather than focusing on the Kuznets hypothesis (Kuznets 1955), the reinvigorated interest in the endogenous theory of growth has fuelled substantial research into the exploration of the impact of inequality on growth. The converging thesis is that inequality is harmful for growth, although the channels through which this effect is transmitted differ in accordance with the model used.

Some models appeal to the imperfection of capital markets (Aghion and Bolton 1997; Chiu 1998; Galor and Zeira 1993). Imperfect capital markets in a world where growth is enhanced by investment in human capital would imply that many poor individuals would not have sufficient income to invest in education and would have no access to borrowing in order to finance it. Other models try instead to build a bridge between theories of endogenous growth and theories of endogenous political economy. Higher inequality would imply, according to the theorem of the median voter, a stronger redistribution through the voting process. Redistribution would affect the net return of investment and would depress growth. (Alesina and Rodrik 1994; Bertola 1993; Perotti 1992; Persson and Tabellini 1994).

Bénabou (1996) develops a model to combine the two previous theories. His model shows that the trade-off between the costs and benefits of redistribution can be represented by an inverted-U curve. It can be shown that "Growth is hill-shaped with respect to redistribution, and the growth-maximising tax rate increases with inequality" (Bénabou 1996, p. 18). Other models focus on the socio-political consequences of inequality. High inequality would have depressing effects on investment and growth because it would cause political turmoil and social instability. A formalisation of these models can be found in Alesina et al. (1996), Bellettini (1996), Benhabib and Rustichini (1996).

Furthermore, Perotti (1996) suggests that the households' decisions on fertility and education could provide the channel through which inequality negatively impacts on growth. Although a model linking these three variables has not yet been formalised, the rationale behind it can be summoned as follows: provided that the cost of education is mainly represented by the income foregone for not working, the unequal society is the one where a wider percentage of the households cannot invest in human capital through education. Accordingly, they would invest in *quantity* of children rather than *quality*. Since growth mainly stems from investment in physical and human capital, the high fertility rate due to high inequality would lead to less investment in human capital and less growth. Becker and Barro (1988) and Becker, Murphy and Tamura (1990) have pioneered the research into the theory of fertility and growth.

More recent developments of this productive strand of literature suggest that social comparisons, coming from the society's perception of inequality, lead to low growth rates, this effect being more relevant in rich economies (Knell 1998).

Whatever the channel, the link between inequality and growth has been tested in different cross-sectional studies with somewhat contrasting results. While the coefficient of inequality has often emerged negative and significant (Alesina-Rodrik 1994; Clarke 1995; Perotti 1994 and 1996; Persson-Tabellini 1994), the link between redistribution and growth is still obscure. According to Capital Markets models, redistribution should have positive effects on growth (it would enhance the possibility for the poor to invest in human capital) while Political Economy models point out that strongly progressive redistributive policies would depress the return of capital, thus decreasing growth. Some empirical studies find a positive coefficient for redistribution while others show the coefficient to be negative, thus emphasising the divergence in the theory. (Perotti 1994 and 1996, Persson-Tabellini, 1994).

This Paper aims to provide the reader with new evidence on the empirical links between inequality and growth and build upon a previous paper by Perotti (1996). First, we use a new database on inequality collected by Deininger and Squire for the World Bank (Deininger and Squire 1996) to improve the accuracy of the econometric estimates of the inequality-growth link. We then move to more detailed tests of the proposed channels of transmission, focusing in particular on the role played by redistribution. We also test Bénabou's hypothesis of a non-linear relationship between redistribution and growth.

The remainder of the Paper is organised as follows: in Section II we briefly review the main empirical evidence from previous cross-country studies, each time referring to the underlying theory. In Section III we introduce the data and the methodology used. In Section IV we present the econometric results for the reduced form of the model, together with some tests of robustness. In Section V we focus on the channels of transmission proposed in the literature. Section VI discusses and concludes.

Section II: Inequality and Growth: where do we stand?

Table 1 summarises the main findings of empirical studies which relate inequality to growth. Almost all the research undertaken on the topic show a negative and significant effect of inequality on growth (Column 1). Some of these works also attempt to find the reason for the link by testing alternative channels of transmission; as briefly mentioned in the previous section, six main families of models can be distinguished: the Political Economy model (PE in the remainder of this paper), the Capital Market imperfections model (CM), the Integrated model (INT), the Socio-Political Instability model (PI), the Fertility/Education issue (FE) and the model based on Social Comparisons (SC). We now briefly review these models.

PE model - In democratic societies, the level of taxation is decided by the median voter. We assume that taxation is proportional to income, and public expenditure progressive (as tax revenues are redistributed lump-sum to everyone); therefore the benefit received by the poor is greater than the benefit received by the rich. Therefore the poor would prefer a high level of taxation-redistribution. Since in unequal societies the income of the median voter is lower than the mean income, majority rule would dictate a high level of redistribution which, in turn, discourages investment by depressing its net return, and lowers growth (Alesina and Rodrik 1994, Bertola 1993, Perotti 1993, Persson and Tabellini 1994). These findings can be summarised in Proposition 1.

> *Proposition 1 - High inequality (i.e., a low ratio of median to mean pre-tax income) leads, according to the theorem of the median voter, to more redistribution and to less growth (through a discouragement of investment).*

The negative impact of inequality would be attenuated, by the degree of "wealth bias" of the system against the poor. The more a society moves away from the democratic archetype of "one man, one vote", the less it is possible to reduce the level of inequality through redistribution. Hence, the previous findings can be extended allowing for different degrees of democracy.

Proposition 2 - The negative effect of inequality on growth is weaker for political systems that are less favourable to the poor (elitist countries or dictatorships).[1]

CM model - The second approach is based on the role played by imperfections in the capital markets: in societies where agents do not have free access to borrowing, inequality implies that a relatively large share of the population is below the threshold cost of education. Therefore investment in human capital is low as is growth.[2] The consequence of this approach, which is outlined by the papers of Aghion and Bolton, (1992 and 1997), Chiou (1998), Galor and Zeira (1993), and Saint-Paul and Verdier (1993), is that redistribution would enter with a positive sign in the growth regression because it would increase the investment in human capital which is positively linked to growth. This leads to the following Proposition.

Proposition 3 - Credit constraints prevent the poor from undertaking the efficient amount of investment and, since there are diminishing marginal returns to investment, inequality leads to lower growth. Redistribution increases total output and growth by allowing the poor to invest in human and physical capital.

INT model - The PE and CM models mainly differ with respect to the role played by redistribution. Redistribution lowers growth according to the PE model but enhances it according to the CM model. Bénabou (1996) provides an integrated framework in which the impact of redistribution on growth is not necessarily linear. He distinguishes two opposite effects. Redistribution is *good* if

[1] In this regard, a proper distinction between different types of dictatorship should be drawn.

[2] This model can be applied to societies where education is provided publicly, privately or through a mix of the two. If education is private, the poor cannot afford to pay its cost, unless income is redistributed. If education is public, its opportunity cost (the income forgone for not working) is however too high for the poor unless income support is received from the State. If the system is a mix, private education is not affordable for the poor which can rely on public education only if taxes to finance it are raised.

public expenditure goes to finance education in a world with imperfect capital markets, and *bad* if it only transfers income from the rich to the poor, because it depresses the net return to investment of the rich. Some of his conclusions can be summarised as follows (see Benabou 1996 for a full description of the model).

Proposition 4 - In PE models with CM imperfections, under any given redistributive policy, inequality reduces growth. This negative effect diminishes with the extent of pre-investment redistribution. i). Growth is inverted-U shaped with respect to redistribution and the growth maximising tax rate increases with inequality; ii). Growth is hill-shaped with respect to the degree of wealth bias in the political system iii). Redistribution is U-shaped with respect to inequality.

PI model - The fourth model, the Socio-Political Instability model, emphasises the consequence of inequality on political instability and social unrest. According to the PI model, inequality is an important determinant of socio-political instability and this, through lower expected returns to investment, has negative effects on growth. While the instability channel has been around for a long time, formal models have only been presented recently by Alesina et al. (1996), Benhabib and Rustichini (1996), Fay (1993) and Grossman and Kim (1996).[3] Some of the conclusions can be summarised as follows.

Proposition 5 - Inequality exacerbates social conflict, which in turn makes property rights less secure and reduces growth.

FE model - Perotti (1996) suggests that inequality has a negative effect on economic growth through the distortion of the households' decisions on education and fertility. Parents have to optimise the use of the household's resources, alternatively through an improvement in quality (education) or in quantity

[3] For example, according to Fay, inequality leads to a larger number of people engaging in illegal activities which pose a threat to property rights and decrease the expected return to investment.

(fertility) of their offspring. Since education has a cost equal to the income foregone while at school, poor households do not invest in human capital but in the quantity of children. However, growth is only enhanced by investment in human capital; therefore, *ceteris paribus*, a society in which there is high inequality presents a relatively larger number of poor households which invest in quantity rather than education. The high fertility rate of this society leads to low growth; this link closes the model and is well known in the literature (Becker and Barro, 1988, Becker, Murphy and Tamura, 1990). We present Proposition 6.

> *Proposition 6 - High inequality implies that many relatively poor households invest in the quantity rather than in the quality of their offspring, thus leading, ceteris paribus, to less investment in human capital and to less growth.*

SC model - Finally, a recent paper has focused on more social and psychological aspects of inequality. Knell (1998) provides an explanation for the suggestion that the link between economic growth and inequality might be stronger in rich countries; he offers a model, directly built on Bénabou (1996), in which individuals make social comparisons. Knell assumes that maximisation of individual utility does not depend solely on own consumption but also on the average consumption of some reference group. In an unequal society, poor households are tempted to conform to the norms and to fulfil social needs and expectations, by involving in higher consumption activities and by lowering investment in human capital in order to reduce the gap with rich households. These activities maximise present welfare but go to the detriment of future welfare and growth. Knell shows that three factors simultaneously determine the effect of inequality on growth: the choice of the reference group, the degree of diminishing returns to investment and the strength of future social comparisons relative to the present ones. Moreover, the impact of inequality on growth would be higher in societies where social comparisons are of greater importance, as it is in developed countries. We present Proposition 7.

> *Proposition 7 - Inequality in societies where social comparisons are of great importance implies that individuals maximise their present consumption to the detriment of investment in human and physical capital, therefore lowering growth.*[4]

While on the theoretical side alternative channels of transmission are presented, the empirical analysis is not conclusive yet, especially on the role played by redistribution. While most of the papers assessed in Table 1 show a negative relationship between inequality and growth,[5] the role of redistribution is puzzling (Columns 2 and 3). The other models are reviewed in the other columns: investment in both physical and human capital enhance growth (Columns 4 and 5). Columns 6 and 7 test the relevance of PI models: empirical results confirm that inequality causes socio-political instability and thereby lowers growth. Finally, Column 8 indicates that capital market imperfections are an impediment to growth whereas Columns 9 and 10 show the relevance of the Fertility/education issue.

Section III: Methodology and Data

Before attempting to shed further light on the relevance of alternative models in explaining the role of inequality on growth, we present the methodology and the data used in this work.

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[4] This last approach, while born as an alternative explanation, can be seen as complementary to previous models. Social comparability can be considered, for example, as the factor underlying the fertility/education decision of a household or leading to illegal activities in the PI model.

[5] Exceptions are Brandolini-Rossi (1995) who use a somewhat unusual sample of countries and period under consideration, Partridge (1997) and Forbes (1997) who use panel data techniques to study the impact of changes in inequality on economic growth within each country. We will discuss this issue in the concluding section.

Methodology - We test the econometric model which, in slightly different specifications has been tested in previous empirical papers:

$$GROWTH = b_1 + b_2 INEQ + b_i X_i + e.. \qquad \textbf{(1)}$$

Where GROWTH is the average growth rate of GDP per capita over the period under consideration, INEQ is a measure of income inequality and X is a vector of control variables which includes income per-capita level (INPC), the level of investment in human capital (HUMCAP) and the investment / GDP ratio (INVEST). We also run model (1) with different specifications of the vector of variables, in order to take into account the effect of other factors likely to affect growth. One of the main purposes of this paper is to test the robustness of the model to different definitions of the variables used in vector X: the series that have been considered throughout the paper will be described below.

In Section 5 we test the proposed channels of transmission in order to test their explanatory power in the growth-inequality relationship. The reduced form of the model (1) is now split into two equations:

$$GROWTH = d_1 + d_2 CHANNEL + d_i X_i + e_g.. \qquad \textbf{(2)}$$

$$CHANNEL = a_1 + a_2 INEQ + a_i W_i + e_c.. \qquad (3)$$

Where CHANNEL is one of the proposed channels of transmission (redistribution, investment in human capital, political instability, fertility) and X and W are vectors of control variables.

Data - Cross-country studies suffer from well-known drawbacks, due to the low degree of comparability of international data. On top of that, income inequality has often been neglected in economic research because of the particular scarcity of good data. In recent years, new and more reliable databases (Deininger and Squire, 1996 and the Luxembourg Income Study database) have been collected and used in empirical studies. Yet, the reliability of the database cannot eliminate other measurement problems that arise when data are compared.

First, the perception of inequality depends on the inequality index used; indices are neither cardinally nor ordinally equivalent and some of them lack basic properties that *good* indices should have. While we refer to Figini (1998a) for a full description of the issue, herein we take this problem into consideration by running the econometric tests to alternative specifications of the variable INEQ. The Deininger and Squire's database, used throughout this paper, presents distribution data grouped in quintiles and only provides one synthetic measure of inequality, the Gini coefficient. The other indices under consideration in this paper are the percentage of income accruing to the bottom quintile (Q1), to the top quintile (Q5) and the ratio between the two quintiles (Q1Q5 - these indices are all Lorenz consistent in a *weak* sense); the percentage of income accruing to the third quintile (Q3) and to the sum of the third and fourth quintile (Q3Q4). This last two indices, which are not Lorenz consistent, have been constantly used in the literature to proxy the gap between the median and the mean income, which is the measure of income dispersion relevant to the theorem of the median voter.

Second, international data come from different sources and use different definitions of income and income recipient units. Some inequality data come from household budget surveys, others from tax returns, some others from nationally non-representative samples. Inequality measures are computed on several recipient units (individual, household, equivalent income, economic active person) and definitions of income (gross income, net income, expenditure). In order to adjust for this problem, we select a uniform subset of data with similar characteristics from the Deininger and Squire database: only data coming from nationally representative household budget surveys are used and, when possible, inequality is measured on gross household income.[6] To avoid effects of reverse causality, inequality is measured in 1970, at the beginning of the period under consideration.[7] In contrast to previous studies, we test the inequality and growth relationship starting from the 1970s rather than the 1960s. The reason is twofold. On one hand we want to update and, if possible, confirm previous findings in a more recent period. On the other hand we want to get rid of many bad measures of inequality and measurement errors or discrepancies in other variables by using data coming only from more recent and, therefore, more reliable sources.

Measurement issues also exist with respect to the other variables: how can concepts such as redistribution, imperfection in the capital markets, human capital or socio-political instability be measured? To address this question, we use those proxies that have been extensively used in the literature as well as allowing some variables to be measured by alternative series constructed in different ways. In doing so, we test the robustness of results to different definitions of the relevant variables. Table 2 presents the series used and some basic statistics. The dependant variable, economic growth, is measured as the log difference of GDP per capita over a 20-year period. Two series have been used, the first (GR7089) taken from World Penn Tables (available from World Bank 1998), the second one (GRWB7090) computed using World Bank data (World Bank 1997).

Our vector of control variables follows a standard approach widely used in cross-country studies of endogenous growth and includes GDP per capita level (INCPC) at the beginning of the period (to check for the convergence

[6] Expenditure inequality is not used to avoid distortions in the comparison of data. Previous papers (Perotti, 1996 and Li et al., 1998) used formulas to translate consumption into income inequality. These adjustments are not applied herein because no definite relationship between consumption and income inequality across countries has been demonstrated to exist. Therefore, such a procedure might decrease the degree of precision with which inequality is measured.

[7] To be more precise, inequality is measured between 1968 and 1972. When several observations from a consistent source are available in one country for that period, the average is considered unless there was a clear

hypothesis), the average ratio of investment to GDP over the period (INVEST) and a measure of human capital (HUMCAP). Some problems arise with respect to the measurement of HUMCAP. First, we have to distinguish between the stock and the flow of human capital. This distinction is important because the latter is the endogenous variable in some of the channels tested here. The best proxy for stock of human capital has recently been considered the average schooling years in the adult population (HUMAN70 in the remainder of the paper). The other variables taken into consideration, such as the enrolment ratio in primary, secondary or higher education (P70, S70, H70) can instead be considered as proxies for the investment in human capital. In what follows, the two alternative definitions are tested in the regressions. Second, it has been argued that a distinction between male and female measures of HUMCAP has to be drawn. Perotti (1996) shows that the former measures enter with negative coefficients while the latter enter with positive coefficients in growth regressions.

While several other variables have been suggested to be linked to growth, we have decided to keep the vector of control variables relatively small, in the difficult exercise of balancing the risks of multicollinearity with the risks of omitted variable bias. However, we test the model with several alternative configurations of the controls. The *basic* model only includes INCPC, INVEST and HUMCAP; in fact: many of the other variables are found to be highly correlated to GDP, to HUMCAP or to inequality (and in this latter case they will be considered as "channels of transmission" in a model including Equations 2 and 3).

We now turn to a brief description of the variables acting as the likely channels through which inequality affects growth. Political instability (POLINST)

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trend in the series, in which case the last value would be taken. In case of two or more contrasting values, we choose the value coming from the most reliable source.

is proxied by two variables, already used in other studies of endogenous growth: an index of civil rights (the Gastil index) and a weighted sum of the annual number of political assassinations and coup d'etat over the period under consideration. Fertility (FERT) is measured by the average number of children per woman in 1970; we also compute the average of this variable over a ten year period (1970-80) to have a more precise measure of the households' decision about fertility over the period under consideration. Imperfections in the capital market (CAPMARK) is measured by the ratio of M2 to GDP in 1970. This measure provides a proxy for the advancement of financial markets and should play an important role as a determinant of investment and growth.

Finally, Redistribution (REDISTR) is the most difficult variable to proxy. The most precise way to measure redistribution is by estimating the change in inequality between gross and net income. Unfortunately, this measure can be only computed for some countries included in the Luxembourg Income Study database and this sample is too small (less than 20 countries) and too homogeneous to provide any significant indication of the role played by redistribution. Since, according to the PE model, the distortionary use of taxation lowers the returns to investment, Perotti suggests the use of the marginal tax rate to measure the level of progressivity of the fiscal system.[8] Finally, more popular but more inexact indices that are considered proxies for the redistributive effort of a fiscal system are the ratio of total government expenditure to GDP and the ratio of tax revenue to GDP.

[8] The marginal tax rate only measures progressivity while redistribution is the result of interaction between the starting degree of inequality, the average tax rate, the level of progressivity and the provision of public goods.

Section IV: Inequality and Growth Reassessed

A. The basic results

Is inequality harmful for growth? The first step in the reassessment of the link between inequality and growth must be the analysis of the reduced-form of the model as in Equation (1). In Column 1 of Table 3 the standard reduced form of the model, which considers average growth between 1970-1990 as a dependant variable, is considered. The independent variables are the level of income per-capita in constant dollars at the beginning of the period, the average ratio of investment to GDP between 1970 and 1990, and the percentage of secondary school attainment in the population in 1970 as a measure of human capital stock. The expected sign of the coefficients is negative for INCPC and positive for INVEST and HUMCAP.

Finally, INEQ is measured by the Gini coefficient in 1970. Several new features are present in this regression with respect to previous studies: i) 1970 (not 1960) is taken as a starting year: this both increases the number of countries for which data are available and improves the quality of data; ii) Only observations maintaining a proper degree of comparability are taken into consideration; this means that, following Deininger and Squire classification, only indices built upon national samples and measuring income (not expenditure) inequality are considered. Throughout the paper, sub-samples which only consider gross and net income inequality or only household or individual inequality will be selected in order to reduce measurement errors stemming from the use of heterogeneous definitions of income. The expected sign of INEQ is negative, meaning that high inequality leads to less economic growth.

Column 1 of Table 3 reports the OLS estimates and, in brackets, their corresponding t-statistics. All the coefficients have the expected sign and are significant at the 5% level except HUMCAP.[9] Although the number of explanatory variables is small, this model explains 37% of the cross-country variation in growth rates. An increase of one standard deviation in inequality lowers the average growth rate by about 0.56% or almost one third of the average growth rate (2%), in line with previous results. This means that two countries, which only differed for one standard deviation in the Gini coefficient of 1970 (11.2 percentage points), ended, ceteris paribus, with a gap of 10% in their income per-capita 20 years later. This effect is sufficiently strong to care, although the impact of investment is much more important. One standard deviation in INVEST cuts in half the average growth rate; after 20 years, two countries with the same income per-capita in 1970 would have a 21% gap in their incomes of 1990 if investment rates differed by one standard deviation.

Many other variables have been considered and included in cross-section studies of economic growth, so many that it has been calculated that, in order to consider all the possible combinations of variables, one should run 3.4 billion regressions (Sala-i-Martin, 1997). We have only investigated a few of them, by considering those variables which have been suggested to interact with growth and inequality in the literature. POLINST, FERT, CAPMARK and the democracy dummy (DEM) all have the expected sign although, when added to the regression, they are insignificant at the 5% level (Table 3, Columns 2 to 10). In those equations, the significance of INEQ is unaffected except when FERT is added. This latter result would suggest that FERT is strongly correlated to INEQ and that, when added into the equation, it would introduce multicollinearity.

The theory does not help us with respect to the sign of REDISTR. According to the PE model, the sign should be negative while the CM approach

[9] As already stated, previous findings suggest that a disaggregation between female and male is needed to better describe the effect of human capital on growth. For a full understanding we refer to related work on the issue

states that more redistribution should instead enhance expenditure for education and therefore investment in human capital and growth. The negative sign of REDISTR would tend to back the PE model, although the variable does not enter significantly in the regression. The significance does not change considerably also when HUMCAP is dropped from the regression (to avoid possible problems of endogeneity). Furthermore, the PE model is not supported by data when the sample is divided between democratic and non-democratic countries. Contrary to the findings of Perotti (1996), our sample does not support this distinction implicit in the PE models, for which the political channel would only work (or work better) in democracies. In the sub-sample of 31 democratic countries for which data are available, INEQ is not significant (Column 7). It is also insignificant in the non-democratic sample (Column 8).[10]

Most of the international variation in growth rates can be explained by regional differences: it is well-known that South East Asian countries have grown faster than Latin American ones. If we add to the regression a regional dummy for Latin America (LAAM), Africa (AFRI), South East Asia (SEAS) and former socialist countries (SOCI) we improve the explanatory power of the regression (to 62%). Moreover, LAAM and SOCI enter with a negative sign and SEAS enters with a positive sign, as expected. More surprising is the positive sign for AFRI (which remains positive, although insignificant, if only Sub-Saharan countries are considered). When regional dummies are added, the sign of INEQ becomes instead insignificant, although still negative. South East Asian countries are relatively equal and grow faster than LAAM countries which have a high degree of inequality. But, what comes first? Is Inequality picking up regional

(see for example Barro and Sala-I-Martin, 1995)

[10] DEM in Column 6 is a dummy built as in Barro-Lee by assigning a value of 1 to countries with a value of the Gastil index of political rights less than or equal to 3. Similar results have been proposed recently by Deininger and Squire (1998).

peculiarities or is equality the key of success of SEAS countries? This remains an open question.

Finally, a long version of the regression is shown in Column 10. The most important variables in determining growth are the initial level of GDP per-capita, the level of investment, the fertility rate and the regional dummies. INEQ becomes almost nil suggesting a high degree of multicollinearity between INEQ and the added variables, as the theory would suggest.

B. The sensitivity analysis

Several tests are run to check for the robustness of results. First, all the variables have been log-transformed (Column 1 in Table 4); no particular changes appear in the significance of the coefficients, the R^2 and the F-statistics with respect to the basic regression.[11] Therefore we keep using the variables in natural numbers.

Two major problems that arise in cross-country studies are the omitted variable bias and heteroscedasticity. Our basic model in the reduced form is a good explanation of economic growth; if we run the Ramsey test for omitted variables, we reject the hypothesis that the model has omitted variables. Hence, we move to adjust for heteroscedasticity. We use two robust estimators: White in Column (2) and Huber in Column (3) and yet, INEQ is significant at the 5% level in this and other specifications of the model.

We now turn to check the robustness of results to alternative configurations of the sample. First, previous papers have suggested that the link between inequality and growth might be particularly strong among rich countries and Knell (1998) uses this as a starting point to justify his investigation. We

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[11] No particular change appears also when ratios (INVEST and HUMCAP) are considered as they are while numbers (INCPC and GINI) are log-transformed.

define as rich those countries whose income per-capita was, in 1970, above the average income per-capita of the sample. This split leaves us with two sub-samples of 25 rich countries (Column 4 in Table 4) and 37 poor countries (Column 5 in Table 4). Contrary to the results of Knell, we find no evidence to support the hypothesis that inequality affects growth prevalently in rich countries. If anything, INEQ works better as an explanatory variable among poor countries (its coefficient is significant at least at the 10% level).

If we replicate the division made by Knell, using as a cut-off point the income per-capita level of the poorest of the OECD countries (Turkey), we are left with a sample of 41 rich and 21 poor countries. In this case the INEQ coefficient in the sample of rich countries is higher than in the basic regression (-0.0007) and significant However, the coefficient of INEQ is -0.0008 and significant also for poor countries. These findings would suggest that there is not a significant difference between rich and poor countries nor a stronger link for middle-income countries (if we drop those countries which GDP per-capita is above or below one standard deviation from the mean, we are left with a sample of 41 countries and the Gini coefficient is now lower (-0.0005) and insignificant (t = -1.45).

Another test which follows the introduction of regional dummies is carried out in Columns (6) to (9) in Table 4. Different regions are alternatively dropped from the sample. We find confirmation of our previous comment: when Latin American or South East Asian countries are dropped (respectively in columns 6 and 8), the inequality-growth link loses significance; when African or former Socialist countries are dropped (respectively in columns 7 and 9), INEQ gains significance. We conclude that the negative link between inequality and growth stems mainly from regional differences between Latin America and South East Asia. Again, is inequality merely an instrument for measuring regional differences or is inequality the key to understanding different growth performances between the two continents? This remains an open question.

Several other samples have been tested by alternatively dropping countries; if anything, the significance of both INEQ and the whole regression improves. As an example, we have dropped, in Column (10) five countries, Poland, Hong Kong, Zambia and Botswana, which all have a higher than normal normalised residual square, and Barbados which, instead has a higher leverage. INEQ is now higher and more significant. Other specifications of the sample have been investigated and the results change only slightly, with INEQ always being significant at the 5% level also when observations very close to the fit are dropped. Therefore we can infer that the link between inequality and growth is not due to the presence of outliers nor to the presence of very strong *inliers*.

C. Which Inequality?

Other standard tests are carried out to check for measurement errors. This issue is particularly important in cross-country studies where some of the variables, namely inequality, are not measured consistently across the sample. As already pointed out, the measure of inequality changes according to the type of recipient unit and to the equivalence scale used to adjust for households of different size. In this sample, household income is usually considered but, for a small number of countries, only personal income inequality is available. Previous works compute the average difference between household and individual inequality for those countries in which both measures are available and then use this factor to derive household income inequality for those countries in which only individual inequality is available. This is the procedure used in Perotti (1996). We avoid this adjustment because the deviation of individual from household income inequality does not follow a linear pattern and varies across countries (Figini, 1998b).

Columns (1) and (2) of Table 5 show the coefficients of the basic model for the sample in which only household inequality data are considered (Column 2 adjusts for heteroscedasticity). We argue that the overall fit improves as does the significance of the Gini coefficient. Columns (5) and (6) show the same regression with individual inequality data only. In this case the fit of regression worsens and the Gini coefficient is not significant at the 10% level, once the regression is adjusted for heteroscedasticity (Column 6). For most of the countries household inequality comes from national household budget surveys and, therefore, has a certain degree of reliability while individual inequality is usually measured when household surveys are not available, which is usually a sign of bad records. Furthermore, individual data are sometimes collected from non-representative samples, sometimes from tax returns. Finally, they are less precise than households, which are the locus of decision with regard to money earning and money spending. These arguments could help explain why Column (5) provides less significant results: first, it mainly includes observations for which inequality is badly measured and, second, that type of inequality is not, by any means, the relevant one in terms of economic decisions. On the other hand, when only reliable and comparable inequality data are used, the significance of the regression improves.

The second problem refers to the definition of income used. For some countries, we avail of gross income inequality, for some others we have net income or expenditure inequality. Previous works transform expenditure into income inequality multiplying the former by a certain adjustment factor (Li at al., 1998). As before, this procedure is not precise because the difference between the two measures of inequality varies across countries. We prefer to drop those observations and consider only the sample for which gross income inequality is measured. This leaves us with a high-quality sub-sample of only 28 countries; the

INEQ coefficient remains significant (Columns 3 and 4).[12] When gross individual income inequality is considered (Columns 7 and 8), we lose only 4 observations and once more, results do not differ significantly. We can conclude that the negative link between inequality and growth is robust to a more precise definition of income and recipient unit used. If anything, bad measurement partially masks the significance of this link.

The last issue with regard to inequality deals with the index used to measure it. Inequality is a multi-dimensional issue and no one index can be considered superior to the other ones: each index measures inequality with particular attention to some aspects of the distributions (Cowell 1995 and Figini 1998a). Table 6 shows the coefficients of the basic regression when alternative measures of inequality are investigated. First, in Column (1), we instrument Gini coefficient to check for measurement errors, by using the ranking of Gini itself. Yet, the accuracy of the regression and the significance of the coefficient improve. The alternative inequality indices used herein are the percentage of income accruing to the bottom 20% (Q1 in Column 2), the bottom 40% (Q1Q2 in Column 3), the median 20% (Q3 in Column 4), the 3rd and 4th quintile (Q3Q4 in Column 5) and to the top 20% (Q5 in Column 6) of the population; the ratio between the bottom and the top quintiles (Q1Q5) is also considered in Column (7). These indices, with the exception of Q5, are all measures of equality and therefore we expect a positive sign of the coefficient. Although the correlation between indices is very high (Figini, 1998a)[13], each index focuses on some

[12] We have to point out that in Columns (1) and (2) of Table 5 net incomes were already dropped. This had left us with two different categorisations: a first one for which income was explicitly gross and a second one for which income was not explicitly defined but for which we assumed (comparing that measure with other measures of gross income inequality for the same country in other years) that they would be gross income. In Columns (3) and (4), only explicitly defined gross income inequality is maintained while in Columns (7) and (8) only gross personal income inequality is considered.

[13] The coefficient of correlation between indices is higher than 0.8 except in the case of Q3 and Q3Q4 with respect to the other ones. Not surprisingly, these two indices are the only ones that, among this group of indices, are Lorenz inconsistent also in the weak sense.

particular aspects of inequality and therefore, we do not necessarily expect the same level of significance when they are placed in the basic model.

However, we obtain significant coefficients for Q1 (Column 2) but the significance decreases when we move away from the tails of the distribution towards the centre. On one hand this is not surprising, because Q3 and Q3Q4 are not by any means considered *good* measures of inequality. The use of appropriate (Lorenz consistent, at least *weakly*) indices of inequality improves the significance of the link between inequality and growth. On the other hand, since PE models base their analysis on the theorem of the median voter, and since the difference between the median and the mean is better proxied by Q3 than by other indices of inequality, our findings would suggest that the PE model is not fully supported by the data. It is also worthwhile to notice that the number of observations available, when quintile measures are used, drops to 35 but that, when Gini is placed in the regression for this sub-sample, the coefficient remains significant (Column 8 of Table 6), implying that these findings do not depend on the particular sub-sample used.

D. Other Measurement Issues

When we move towards problems linked to the measurement of other variables, we face two major issues: first, some of the concepts introduced in the theory, such as political instability and redistribution have to be translated into meaningful variables. Second, given the availability of data from different sources we can check the robustness of results to measurement errors, by using alternative sources, and to alternative definitions of variables, such as human capital or redistribution. In order to accomplish this task, we have tested our model by replacing the series used so far with the others listed in Table 2. If a variable is badly measured or defined, it is unlikely that the same problem appears in series coming from different sources or with different definitions.

In column (1) of Table 7 we change the series used to measure GROWTH and INCPC, using now data from the WDI (World Bank, 1997). Results are only slightly different; in particular HUMCAP changed sign, although the coefficient is not significantly different from zero. INEQ is still significant at the 5% level, and its impact on growth is the same. The significance of INCPC is unaltered, suggesting that there is a significant validation of the convergence hypothesis. Income is often badly measured, one possible way to check for measurement errors is through the use of an instrument for INCPC. We use the ranking of GDP1970 as a proxy for INCPC. The significance of GDP increases and the significance of INEQ drops to the 10% level, suggesting that errors in the measurement of INCPC could result in inflating the role played by inequality in economic growth. We do not find similar problems when we instrument for the other variables.

In Column (3) we use an alternative series, coming from Levine (World Bank, 1998), to measure INVEST. This series uses the same source (the WPT) that has been used in the previous equations, the only difference being that the observations from 1970 to 1973 have been dropped. We notice that the fit of the equation and the significance of INEQ improve substantially. One possible explanation relies on the fact that unreliable investment data, which might affect the significance of the regression, could have been dropped.

When we address HUMCAP we have to recall the distinction between stock and investment of human capital. First, in models of endogenous growth, the stock of human capital at the beginning of the period is considered the variable of relevance. A good proxy for this concept is assumed to be the average number of schooling years of the adult population. Other measures, which instead have been suggested to be proxies of investment in human capital, are the enrolment ratio in primary, secondary or higher education. Since investment in human capital is endogenous to the level of inequality according to the model of CM and to the theory underlying the fertility choice, it is not used in the basic regression of Table 3. However, a measure of investment in human capital appears in Column 4 of Table 7. Another measure of stock appears instead in Column 5 of Table 7.

Our findings suggest a number of observations: first, the coefficient of INEQ always remains significant, with both measures of stock or flow of human capital; second, the coefficient of HUMCAP is never significant, and this can stem from the aggregation of male and female human capital data altogether. Third, an alternative method to correct for the possible endogeneity of HUMCAP with respect to INEQ would be to drop HUMCAP altogether. This has the effect of increasing substantially the significance of the regression (the F-statistics is now 11.83) and of the INEQ coefficient ($t = -3.024$).

More has to be said on the lack of significance of the coefficient of HUMCAP across different specifications: first, as previously seen, there can be endogeneity problems between human capital and inequality. Second, HUMCAP is strongly positively correlated to INCPC. Third, as recalled above, a separation between male and female human capital would be more appropriate to represent the role played by this variable.

When other measures of POLINST and FERT are used, as in Columns 6 and 7 of Table 7, we find that, while the INEQ coefficients are basically the same, POLINST and FERT have lower significance levels, perhaps a consequence of the fact that they are badly measured.

E. The Measurement of Redistribution

In the PE model, agents respond to a certain perceived inequality by voting for redistribution in order to reduce it. Therefore, the difference between gross and net income inequality brought about by the voting process would be the best variable to use in the econometric estimate of the model. This measure is only available for a sub sample of 20 countries, too small and homegenous (it mainly includes OECD countries) to provide any suggestion of links between inequality and growth (see also Brandolini, 1995).

Redistribution depends on four components: the initial level of inequality, the average tax rate, the degree of progressivity of the fiscal system and the extent and type of provision of public goods. This last issue is particularly important as it presents the main channel of investment in human capital. Furthermore, we also cannot ignore that the extent of gross income inequality is mainly the result of a redistributive effort promoted by the state through the provision of pensions, social welfare and income policies. While these issues are somehow caught by measures of tax revenues or public expenditure, other issues such as the legislation on capital gains, collective contracts, wage ceilings and minimum wage all impose very strong constraints on the level of pre-tax inequality but are not picked up by any index of redistribution. The lack of a comprehensive index of redistribution able to encompass all these components suggests that existing measures of redistribution only provide a partial representation of it.

Having said that, the more precise index of redistribution we avail of is the marginal tax rate. This is the measure used in Column (5) of Table 3. An alternative measure, less precise in measuring the progressivity but more focused on the total burden of taxes, is given by the ratio of tax revenues to GDP, as in Column (9) of Table 7. In Column (8) the ratio of public expenditure to GDP is used as a measure of redistribution.

According the the PE model, redistribution should enter with a negative sign in the regression while, according to CM model redistribution would enhance investment in human capital and economic growth. Our results are inconclusive and in line with previous research. The coefficient of REDISTR is always insignificant and generally has a negative sign. But the sign can also be positive, as in Column (10). We conclude by arguing that redistribution is not precisely measured because it theoretically includes several aspects which are not caught by existing indices. However, none of the indices herein used enter significantly in the growth regression nor is the impact of redistribution on growth sufficiently clear.

F. Long Run vs. Short Run Growth

Finally, another issue involved in this kind of studies relates to the time horizon taken into consideration. Theoretical models are built on inter-generational growth patterns; therefore, long-run economic growth is usually investigated. Most of the previous studies analyse the effects of inequality on growth over a period of 20 - 25 years, starting from 1960. As we have seen so far, our findings with respect to growth from 1970 are in line with previous results related to 1960.

In Columns (1) and (2) of Table 8 the dependent variable changes to growth between 1970 and 1995. Whilst some observations are lost (our sample reduces from 62 to 55 countries) the link is strengthened. In particular, the role played by INEQ is stronger and more significant. Also the long version of the model (Column 2) has a much better fit although some findings are curious. INEQ is still significant at the 10% level while FERT now enters with a very strong negative sign in the regression. Also, INVEST surprisingly loses its significance and LAAM and AFRI enter the regression with a positive although insignificant sign.

When we test a 10-year period (Columns 3 and 4 of Table 8 refer to the 1970-1980 period and Columns 5 and 6 to the 1980 to 1990 period) INEQ becomes insignificant as generally the regressions have a worse fit. Surprisingly, INEQ assumes a positive, although insignificant sign in Column (4). Column (6) highlights that growth has moved in recent years from a general to a more particular pattern, this fact being clear considering the strong negative sign of LAAM and SOCI, due respectively to the debt crisis and to the disruption of socialist economies in the past decade. The analysis of the 10-year period also suggests that, as expected, INEQ has a more significant role to play in long-run growth while in the medium term other factors, more related to the business cycle or to regional peculiarities, are more relevant explanatory variables of growth.

In the last three columns of Table 8 we focus more carefully on growth in the 1980s. In Column 7, the Gini coefficient does not enter in the equation significantly. When other measures of inequality are used, particularly when the percentage of income accruing to the middle 20% of the population is used as an index of inequality, both the significance of INEQ and of the whole regression improve. This would suggest that PE models could have become more appropriate in the explanation of growth in the last decade. Several other model specifications have been investigated on our database but no other interesting finding has to be signalled nor are the results above discussed contradicted by different model specifications or choices of variables.

Section V: From Inequality to Growth: how?

Provided that the link between inequality and growth is supported by the data, we now investigate the theoretical models that have been suggested in the literature to explain this link. To achieve this target, we split the models into two equations, the first linking inequality to the channel of transmission (Equation 3), the second linking the channel itself to growth (Equation 2).

A. The Political Economy Approach

According to the PE model, a high initial level of inequality would lead to higher redistribution; this constitutes the first equation of the model, for which inequality and redistribution are expected to be positively linked. The second equation is from redistribution to growth: high redistribution would discourage investment by lowering its net return and thereby reducing growth. In column 1 of Table 9 we present the reduced form of the PE model in which we control for DEM, a democratic dummy. Its sign, as expected, is positive although it does not enter significantly in the regression. In Columns 2 and 3 we test the first part of the model, from inequality to redistribution. Using the percentage of tax revenues over the GDP as a measure of redistribution, we find that, contrary to what is expected, countries with high inequality are the ones that redistribute less. The sign of INEQ is always negative, although never significant, also when other alternative definitions of redistribution (as MARTAX in Column 3 or the ratio of government expenditure to GDP) are enclosed into the equation.

With respect to the second part of the model, we would expect a negative sign of REDISTR in the growth equation. Columns 4 and 5 in Table 9 do not support this thesis. The coefficient of REDISTR is not significantly different from zero and it is only for the records that we signal a positive sign for TR7090 (Column 4) and a negative sign for MARTAX (Column 5). We have also tried to split the second part of the model into two equations: from redistribution to investment (Columns 6 and 7) and from investment to growth (Column 8). The positive link between INVEST and GROWTH offers no surprise, whilst the channel proposed by the PE model is still not supported by data. REDISTR is not a significant explanatory variable of INVEST and, if anything, redistribution would help investment.

While the PE model is not justified by empirical regularities, on the other hand it is necessary to highlight once more those major arguments that impede a proper test of the role played by redistribution. We have already argued that most of the redistributive effort of a country is implemented before gross income inequality is measured; therefore redistribution is somehow endogenous to the measure of inequality and it is nearly impossible to distinguish the role played by the two variables. In other words, there would exist a problem of reverse causality and the measure of inequality in Columns 2 and 3 would already be affected by the extent of redistribution.

In what follows, we assume that each country has the same distribution of endowments and that, given its own social aversion to inequality, the extent of inequality measured in the country is the result of its redistribution. We assume that inequality is high in one country because its redistributive effort is weak and, vice versa, inequality is low in another country because of its very strong equality commitments. We therefore expect a negative sign of the coefficient of REDISTR when INEQ is regressed against it.

In Columns (9) and (10) of Table 9, we basically run the regression tested by Li et al. (1998) by inserting REDISTR into the equation. INEQ is expected to be negatively affected by HUMCAP, a proxy for the social aversion to inequality of a society (the higher the level of education, the higher the social aversion to inequality and therefore the lower the extent of inequality), positively linked to POLINST (the higher the instability in the country, the higher the power of the rich to maintain their dominance on the society) and negatively linked to CAPMARK (the higher the financial development, the higher the possibility for poor to invest in human capital, the lower the resulting inequality).

The fit of the regression is good and HUMCAP, REDISTR and CAPMARK all have the expected sign and, except CAPMARK, are significant.[14] More ambiguous is the sign of POLINST. Contrary to what is expected and to the findings of Li et al., socio-political instability would lead to low inequality. These results are robust to different specifications which are not presented here.

Therefore, we conclude by arguing that much of the redistributive effort is implemented before inequality is measured; consequently, countries with low inequality are actually the ones that redistribute more. However, this specification also contradicts the PE model: if countries that redistribute more depress investment and growth, we would expect that more inequality (itself the result of weak redistribution) would be linked to high growth, which is not true. On this basis, we have more evidence to reject the PE model.

B. The Capital Market Imperfection Approach

Another model proposed in the literature, which has often been considered alternative to the PE approach because of the different role played by redistribution, is the one based on capital markets imperfections. Column 1 of Table 10 shows that the reduced form of the CM model supports the theory: inequality is detrimental for growth because, given imperfections in the capital market, poor households cannot invest in human capital which enhances economic growth. In Column 1, HUMCAP is dropped from the equation because in the CM model it is endogenous to INEQ, while CAPMARK is added to control for the development of capital markets. The overall fit of the regression improves with respect to the basic equation of Table 3, as does the significance of the coefficient of INEQ. CAPMARK has the expected sign although it is significant at the 10% level only.

[14] We remind the reader that in Column 10 the dependant variable is Q3 which is a measure of equality; therefore all the signs are reversed.

The CM model can be tested through two equations; in the first part we assume that, for any given imperfection in the capital markets, investment in human capital increases as inequality decreases. Columns (2) and (3) test this part of the model in which INEQ has the expected negative sign but, noticeably, CAPMARK has a negative, rather than positive, coefficient. In the second part of the model, investment in human capital enhances growth, as is verified by Column (4).

As seen in the previous sections, CM distinguishes itself from PE with regard to the role of redistribution. High redistribution, if that means provision of public goods such as education, would enhance human capital and growth. We have therefore tested the impact of redistribution on human capital in Columns (7) and (8), but this link is not particularly supported by the data. REDISTR has a positive but insignificant sign and the total fit of the regression is slightly worse than the one where INEQ was directly used (Columns 2 and 3).

Considering what we have assumed above with respect to the reverse causality between inequality and redistribution, we can infer that the CM model is supported by the data. First, high inequality is the result of weak redistributive commitment (Columns 9 and 10 in Table 9); second, for any given degree of imperfection in the capital markets, inequality is detrimental to human capital (Columns 2 and 3 in Table 10) or, in other terms, strong redistributive policies enhance investment in human capital (Columns 7 and 8 in Table 10). Finally, human capital is positively linked to growth (Column 4 in Table 10).

C. The Integrated Model

Bénabou's approach is more sophisticated because it tries to integrate the PE and the CM approaches. It suggests that growth is inverted-U shaped with respect to redistribution: a modest redistribution is positive because it improves the access to education and therefore increases human capital; however, if redistribution is too much, it goes to affect the net returns to private investment, thus leading to less economic growth. These theoretical findings are somehow complicated by the impact of wealth bias of the political system. Bénabou suggests that growth has an inverted-U shape also with respect to the degree of wealth bias in the political system.

In Table 11 we attempt to provide first empirical evidence for the theory. We proxy the wealth bias with PRIGHTSB, the Gastil index of political rights over the 1970s and 1980s, and its squared term PRIGHTS2 to control for the expected hill-shape. Whether this approximation is questionable or not is an issue that we will discuss in the final section; at the moment we assume that the most democratic countries, which have very low wealth bias, have also very low political instability. On the contrary, countries that are far from the ideal of democracy are the ones more biased towards the rich and the ones with highest political instability.

The econometrics takes the form of two parts. In the first one, redistribution is regressed against inequality, while in the second part growth is regressed against redistribution. Some of the preliminary results are listed in Table 11. First, as Bénabou suggests (Bénabou, 1996, Proposition 6, part 3, p. 21), taxes are U-shaped with respect to inequality. In fact, in Columns 3 and 4 of Table 11, the coefficients of INEQ and INEQSQ are respectively negative and positive. Redistribution is also U-shaped with respect to the level of wealth bias. With respect to the second part of the model, Bénabou suggests that growth is hill-shaped with respect to redistribution, (Bénabou, 1996, Proposition 4, part 2, p. 18) and hill-shaped also with respect to the wealth bias of the political system (Bénabou, 1996, Proposition 6, part 1, p. 21). This specification is tested in Column 6: while the signs of the coefficients are the expected ones, their explanatory power and the fit of the whole regression are very low. A better specification seems to be Column (7) in which REDISTR has a hill-shape, it is fairly significant and POLINST enters linearly in the regression, with a negative sign. We also control for the level of overall inequality and for the level of GDP per-capita. Another specification of the model is presented in Column 8, where a dummy variable for democracy, DEMDUM is built by giving values of 0 to non-democratic countries, 1 to countries with intermediate levels of democracy and 2 to democratic countries. This dummy, however is built upon the Gastil index of civil rights.

The evidence shown in Table 11 has to be briefly discussed. First, the complexity of the relationships suggested by the theory invokes further empirical research. Second, as previously pointed out, there might be problems of bad measurement with respect to REDISTR (existing measures only provide partial representations of redistribution) and with respect to how to proxy the wealth bias. Third, the present findings suggest an alternative explanation for the relationship between inequality and redistribution compared to the one insinuated before (reverse causality): the relationship could be non-linear and depicted by a U-shape.

D. The Socio-Political Instability Approach

The next theoretical apparatus that we test is the PI model. We split the impact of inequality on growth in two parts; first, we assume that the degree of inequality determines the level of social turmoil and unrest in the country. Second, the degree of social instability goes to affect the propensity to invest and hence growth. We expect the coefficient of INEQ in the first regression to be positive and the coefficient of POLINST in the second regression to be negative. While Column (1) of Table 12 provides a starting point towards defining the role played by political instability in the model (POLINST enters the basic regression with a significant negative sign and its introduction improves the fit of the model), the test of the full form of the model is carried out in Columns (2) to (5).

Our results are puzzling, if compared to previous findings. While political instability seems to be an impediment to growth (POLINST is negative in Columns 4 and 5), its statistical insignificance casts a doubt on the validity of the model. Moreover, the link between inequality and political instability is not clear. A very simple regression of POLINST against INEQ shows a positive relationship between these two variables, but the coefficient of INEQ changes sign as soon as other control variables are added to the regression. In Column (3), when INCPC and HUMCAP are added, INEQ becomes negative although insignificant. We can conclude by arguing that social and political instability is an important variable in explaining growth but it seems to work independently from inequality rather than being its channel of transmission to growth (see also Alesina et al., 1996).

E. The Fertility Approach

Finally, we test the empirical evidence behind the fertility issue. This approach shares some ideas with the CM model and with the model developed by Chiu (1998). We argue that high inequality in a society with imperfect access to borrowing implies that a relatively important share of households is poor and cannot invest in human capital. They confront the lack of income by investing in *quantity* of children; therefore, in the first equation of the model, inequality is positively linked to fertility. Since human capital is a positive factor for growth, an investment in quantity rather than quality of the households' offspring increases present consumption but reduces future growth. Hence, the second equation of this approach indicates that fertility is negatively linked to growth. A further breakdown is here possible: fertility is negatively linked to investment in human capital and human capital is a positive component of economic growth.

The evidence for this approach is quite strong. In Column 1 of Table 13 we review the basic regression by dropping HUMCAP and adding FERT. The coefficient of FERT is negative but insignificant, suggesting that part of its impact on growth might work through inequality. The full form of the model is tested in Columns 2 to 5. Column (3) shows that INEQ has a positive and very significant coefficient, stating that high fertility rates stem from high inequality levels. A more precise representation of the model is suggested in Column (3). We introduce a measure of financial development to control for the access to borrowing and we drop HUMCAP from the equation to avoid problems of endogeneity. This specification is highly significant and explains 76% of the fertility rates.

Moving to the second part of the model, we investigate in columns 4 and 5 the effect of fertility on growth. We find a significant negative impact of FERT on economic growth (at least at the 10% level) in line with previous results although the significance of the coefficient of FERT mainly depends on the specification of the vector of control variables. In Columns (6), (7) and (8) we test a further disaggregation of the model. High fertility rates would lead to low investment in human capital (and the link is more significant when S70, the enrolment rate in secondary education, is used as a proxy for the investment in human capital, as in Column 7) while HUMCAP enters significantly and with the expected sign into the growth equation (8). These findings are robust to alternative specifications and are supportive of the idea that fertility is the channel through which low growth stems from high inequality. Moreover, this approach can be considered complementary, rather than alternative, to the CM model, suggesting that the fertility-education issue is the likely channel through which inequality affects economic growth.

Section VI: Discussion and Concluding Remarks

In recent years, much effort has been spent in attempting to shed light on the relationships surrounding inequality and growth. This paper attempts to discuss the main theories and to provide new data and new roads to explore in order to provide an explanation for the empirical evidence. In the first part we have presented a detailed analysis of the reduced form of the model, linking inequality to growth directly.

First, inequality is harmful for growth in a cross-section of countries (the scatter plot of the relationship, as it is from Column 1 of Table 3 is pictured in Fig. 1). This evidence is robust to several alternative specifications of the model and of the variables used. We warn, however, that it is not appropriate to infer that anti-inequality policies are good policies for enhancing growth. The evolution of inequality within countries does not provide such evidence as Forbes (1997) and Partridge (1997) discuss. They find that decreases in inequality within one country do not bring about increases in the growth rate; inequality seems to be somewhat like an *original sin* destined to affect the long run economic performance of a country.

Second, the sensitivity analysis shows that the negative link between inequality and growth is not due to problems of omitted variable bias, heteroscedasticity, presence of outliers, measurement errors or particular data used.

Third, the separation between democratic and non-democratic countries and the one between rich and poor countries do not seem to provide any evidence that the link is stronger in those sub-samples of countries. On the contrary, cross-country variation of inequality reflects strong regional differences. Latin America is mainly a region of high inequality and low growth while South East Asia is exactly the other way round. Whether inequality picks up peculiar institutional and cultural differences between regions or rather is inequality the key to explain the different economic performance of those regions is still a matter of debate.

Fourth, the index used to measure inequality has a role to play in the explanation of the relationship. The negative coefficient of INEQ is stronger when the Gini index is used, less strong when other weakly Lorenz consistent indices are used and weak when a proxy of the median-mean difference is used. This contradicts previous results and suggests that, if any, bad measurement in inequality downsizes its real effect on growth.

With respect to the proposed channels of transmission we can make other few remarks, which can be summarised as in Table 14. First, the PE approach seems the least supported by data. One, there is not a clear relationship between inequality and redistribution and between redistribution and growth. Two, using the relevant index of inequality in the theorem of the median voter, which is the percentage of income accruing to the 3rd or to the 3rd and 4th quintiles of the population, we have no support for the link. Three, contrary to the theory, there is no evidence that the above relationship works better in democracies rather than in non democracies. Four, the only evidence that could support the PE model (more inequality to less investment and hence less growth) does not seem to go through redistribution and might rather stem from alternative hypothesis (i.e., the PI model).

Second, there is stronger evidence to support the CM theory. One, financial development leads to more growth because, it is argued, it helps poor households invest in human capital. Two, high inequality lead to a low level of investment in human capital. Three, human capital is a positive component of growth. However, it seems that the model improves its explanatory power if it is complemented by the fertility issue rather than working through redistribution.

Our findings strongly confirm previous results of Perotti (1996) for which countries with high inequality and low development of financial markets are the ones with high fertility rates which in turn have low economic performance.

Third, the role of redistribution has to be rethought. High inequality does not lead to more redistribution, more redistribution does not lead to less investment (as the PE model suggests) and the positive link between redistribution and investment in human capital is not statistically significant (as expected in the CM model). To clarify the role of redistribution, a different idea has been suggested in this paper: a reverse causality between inequality and redistribution, because of the relevant role played by redistribution policies implemented before gross income inequality is measured. Accordingly, each country's overall level of inequality would be determined by its own redistributive effort, together with other social and political factors. This idea tends to be supported by the data. Alternatively, Bénabou's model suggesting a quadratic link between inequality, redistribution, wealth bias and growth is fairly supported by the econometrics. More evidence is therefore needed to reach a firm conclusion on the role played by redistribution in growth models.

Fourth, the PI model is not completely supported by data, since countries with high political instability seem to be the ones with less inequality. Yet, socio-political instability is negatively and significantly linked to growth.

To conclude, it seems that the human capital-fertility approach better fits the evidence provided by the data but some issues have to be investigated in future research. First, the measurement of redistribution and its role in growth regressions has yet to be clarified. Second, the development of a theoretical model explaining the link between inequality, decisions in terms of education-fertility and subsequent growth is needed to provide the theoretical background to the empirical evidence.

Table 1 - Inequality and Growth: where do we stand?

Paper	Ineq to growth or invest.	Ineq to Redistr	Redistr to growth or invest.	Invest to growth	Humcap to growth	Ineq to polinst	Polinst to growth	Capmark to growth	Ineq to Fert	Fert to growth
Alesina-Rodrik (1994)	-				+					
Benhabib-Spiegel (1994)	**(-)**			+						
Bourguignon (1994)	-				+					
Brandolini-Rossi (1995)	**?**									
Clarke (1995)	-				+					
Deininger-Squire (1996)	**(-)**									
Forbes (1997)	+									
Kenworthy (1995)	-									
Knell (1998)	**(-)**									
Partridge (1997)	+									
Perotti (1994)	-	**(-)**	**(+)**		**?**	+	**(-)**	-		
Perotti (1996)	-	**(+)**	+		+	+	-	**(?)**	+	-
Persson-Tabellini (1992)	-				+		**(-)**			
Persson-Tabellini (1994)	-	**(+)**	**(-)**		+		-			

Notes: The variables described in this table are measured in several alternative ways but, for reasons of synthesis they are grouped under these headlines. For a detailed list of variables, see the original papers. "-" and "+" mean respectively negative and positive coefficients, significant at the 5% level. "(-)" and "(+)" mean respectively negative and positive coefficients, not statistically significant at the 5% level. "?" means inconclusive results.

Table 2 - Statistical Analysis of the data for the 1970-1990 time horizon

Variable	Series	Description	Source	No. Observ.	Mean	Standard Dev.	Minimum	Maximum
GROWTH	1 Gr7089	Annual growth rate of gdp per capita, 1970-1989	WPT	66	0.020	0.019	-0.022	0.069
	2 Grwb7090	Annual growth rate of gdp per capita, 1970-1990	WDI	65	0.018	0.020	-0.021	0.084
INCPC	3 Gdp1970	GDP per capita, 1987 US dollars	WPT	67	4108	3254	431	12706
	4 Gnppc70	GNP per capita, 1970 US dollars	WDI	62	1135	1159	60	4960
INVEST	5 Inv7489	Investment / GDP, 1974-1989	Levine	68	0.22	0.07	0.03	0.39
	6 Inv7080	Investment / GDP, 1970-1980	WDI	60	0.25	0.06	0.09	0.46
	7 Inv37	Investment / GDP, 1970-1989	Barro	68	0.22	0.07	0.03	0.39
HUMCAP	8 Human70	Average school. years in the pop.>25 years, 1970	Barro	64	4.7	2.6	0.4	10.1
	9 Pri70	Percentage of primary school att. / tot. pop., 1970	Barro	64	48.1	19.5	8	84.4
	10 Sec70	Percentage of sec. school att. / tot. pop., 1970	Barro	64	17.7	14.8	0.5	63.9
	11 Hig70	Percentage of high school att. / tot. pop., 1970	Barro	64	4.1	4.6	0	22.3
	13 P70	Total gross enrol. ratio, prim. school, 1970	Barro	67	0.88	0.19	0.34	1
	14 S70	Total gross enrol. ratio, sec. school, 1970	Barro	67	0.43	0.27	0.03	1
	15 H70	Total gross enrol. ratio, high school, 1970	Barro	67	0.09	0.09	0	0.49
INEQ	16 Gini	Gini coefficient, 1970	DS	75	43.3	11.2	21.5	63.4
	17 Q1Q5	Ratio of the bottom and top quintile, 1970	DS	43	4.25	0.88	3	6
	18 Q1	percentage of income of the bottom quintile, 70	DS	43	5.3	2.3	1.6	10.8
	19 Q3	percentage of income of the third quintile, 1970	DS	43	15	3	9.5	20.85
	20 Q5	percentage of income of the top quintile, 1970	DS	43	48.1	9.51	32.3	65.3
POLINST	21 Prightsb	Index of civil rights (1 more freedom to 7), 72-89	Barro	69	3.26	1.83	1	6.39
	22 Pins7080	0.5(Assassinations)+0.5(revolutions), 1970-1980	Barro	67	0.09	0.14	0	0.68

(Table 2 – continued)

Variable	Series	Description	Source	No. Observ.	Mean	Standard Dev.	Minimum	Maximum
FERT	23 Fert70	Children per woman, 1970	Barro	65	4.56	1.92	1.83	8
	24 Fert7080	Children per woman, average 1970-1980	WDI	69	4.18	1.90	1.58	8
CAPMARK	25 M270	M2 / GDP in 1970	Easterly	60	0.35	0.18	0	0.94
REDISTR	26 Martax	Marginal Tax Rate	Easterly	50	32.2	22.2	-0.1	142
	27 Exp7090	Gov. Expenditure / GDP, 1970-1990	WDI	66	28.3	11.4	11.8	63.4
	28 Tr7090	Tax revenue / GDP, 1970-1990	WDI	66	21.4	9.5	7.1	46.8
	29 Tax7489	Tax revenue / GDP, 1974-1989	Levine	49	22	9.1	7.2	44
	30 L82z	Gov. Expenditure / GDP, 1970-1988	Easterly	52	31.4	11.5	12.9	70.2
	31 L81y	Total revenue / GDP, 1970-1988	Easterly	53	26.4	10.3	10.7	53.7
DEM	32 Dem	Democracy dummy	Own calc.	69	0.464	0.502	0	1
REGION	33 Laam	Latin American dummy	Own calc.	75	0.213	0.412	0	1
	34 Afri	African dummy	Own calc.	75	0.173	0.381	0	1
	35 Seas	South East Asian dummy	Own calc.	75	0.120	0.327	0	1
	36 Soci	Socialist dummy	Own calc.	75	0.067	0.251	0	1

Notes: The most relevant variables used in the present work are above summarised. This table refers to the 20-year growth period, from 1970 to 1990. Some of the series allow a different construction for alternative time horizons, which are used in Table 8, but the statistics are not shown for brevity. Data are available from the author upon request. Source: Barro, DS (Deininger-Squire), Easterly, Levine, and WPT (World Penn Tables Mark 5.6) are all available on-line (World Bank, 1998). WDI = World Development Indicators (World Bank, 1997).

Table 3 - Is Inequality Harmful for Growth?

GROWTH	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**
Constant	0.0220	0.0417	0.0324	0.0286	0.0287	0.0219	0.0117	0.0264	0.0155	0.0728
	[1.339]	[2.216]	[1.706]	[1.893]	[1.655]	[1.338]	[0.470]	[1.116]	[1.091]	[3.139]
INCPC	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001
	[-3.411]	[-4.014]	[-3.528]	[-3.837]	[-3.342]	[-3.499]	[-3.080]	[-1.622]	[-2.468]	[-3.416]
INVEST	0.1376	0.1374	0.1210	0.1190	0.1669	0.1370	0.1280	0.1462	0.1183	0.0772
	[3.980]	[4.075]	[3.203]	[3.506]	[3.985]	[3.962]	[2.874]	[2.498]	[3.584]	[2.308]
HUMCAP	0.0002	0.0001	0.0002	0.0002	0.0001	0.0002	0.0002	0.0003	0.0002	0.0001
	[0.953]	[0.705]	[0.780]	[0.926]	[0.317]	[0.914]	[1.090]	[0.530]	[1.065]	[0.668]
INEQ	**-0.0005**	**-0.0006**	**-0.0004**	**-0.0007**	**-0.0007**	**-0.0005**	**-0.0002**	**-0.0006**	**-0.0004**	**-0.0001**
	[-2.155]	**[-2.535]**	**[-1.384]**	**[-2.821]**	**[-2.812]**	**[-2.177]**	**[-0.577]**	**[-1.688]**	**[-1.519]**	**[-0.400]**
POLINST		-0.0032								-0.0038
		[-1.991]								[-1.404]
FERT			-0.0025							-0.0060
			[-1.086]							[-3.052]
CAPMARK				0.0125						-0.0024
				[0.994]						[-0.231]
REDISTR					-0.0076					-0.0003
					[-0.824]					[-1.074]
DEM						0.0053				-0.0169
						[1.022]				[-1.863]
LAAM									-0.0082	-0.0188
									[-1.587]	[-2.758]
AFRI									0.0154	0.0119
									[2.100]	[1.302]

(Table 3 – continued)

GROWTH	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
SEAS									0.0186	0.0090
									[3.134]	[1.135]
SOCI									-0.0156	Dropped
									[-1.576]	
Obs.	62	62	62	53	47	62	31	31	62	51
R^2	0.3699	0.4115	0.3829	0.4604	0.4326	0.3814	0.3579	0.4061	0.6200	0.7474
Adj. R^2	0.3257	0.3590	0.3278	0.4030	0.3634	0.3262	0.2592	0.3148	0.5626	0.6677
F	8.37	7.83	6.95	8.02	6.25	6.91	3.62	4.45	10.81	9.37

Notes: OLS estimators; t-statistics in brackets. Column (1): The variables used (see Table 2) are: GR7089, GDP1970, INV37 SEC70 and GINI. Column (2): as in Column (1) plus PRIGHTSB. Column (3): as in Column (1) plus FERT7080. Column (4): as in Column (1) plus M270. Column (5): as in Column (1) plus MARTAX. Column (6): as in Column 1 plus DEM. Column (7): as in eq (1) but sub-sample of only democratic countries. Column (8): as in Column (1) but sub-sample of only non-democratic countries. Column (9): as in Column (1) plus regional dummies LAAM, AFRI, SEAS and SOCI. Column (10): as in the previous ones except that TR7090 is the measure of redistribution. F-statistics are always significant at the 1% level.

Table 4 - Sensitivity Analysis

GROWTH	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Constant	0.2455	0.0220	0.0232	0.0462	0.0177	0.0180	0.0334	0.0097	0.0330	0.0308
	[5.094]	[1.516]	[1.449]	[1.236]	[0.939]	[1.005]	[1.910]	[0.599]	[2.045]	[2.324]
INCPC	-0.0130	-0.001	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001
	[-3.512]	[-3.493]	[-3.287]	[-1.728]	[-2.399]	[-3.454]	[-3.312]	[-1.730]	[-4.418]	[-4.221]
INVEST	0.0298	0.1376	0.1318	0.0730	0.2020	0.1211	0.1138	0.1005	0.1707	0.1416
	[4.128]	[3.933]	[3.904]	[1.260]	[4.305]	[3.288]	[3.138]	[2.795]	[4.988]	[4.799]
HUMCAP	0.0028	0.0002	0.0002	0.0002	-0.0002	0.0002	0.0002	0.0001	0.0001	0.0001
	[0.891]	[1.433]	[0.790]	[0.847]	[-0.495]	[1.171]	[1.048]	[0.781]	[4.988]	[0.564]
INEQ	**-0.0220**	**-0.0005**	**-0.0005**	**-0.0009**	**-0.0004**	**-0.0003**	**-0.0007**	**-0.0003**	**-0.0008**	**-0.0007**
	[-2.360]	**[-2.076]**	**[-2.155]**	**[-1.518]**	**[-1.609]**	**[-0.923]**	**[-2.919]**	**[-1.093]**	**[-3.245]**	**[-3.541]**
Obs.	62	62	62	25	37	46	57	53	59	57
R^2	0.3751	0.3699	0.3699	0.3443	0.4779	0.3366	0.4167	0.2200	0.4704	0.5221
F	8.55	6.69	8.20	2.68	7.32	5.20	9.29	3.39	11.99	14.20

Notes: OLS estimators; t-statistics in brackets. Column (1): The variables used are GR7089 and the natural logs of GDP1970, INV37, SEC70 and GINI. Column (2): GR7089 GDP1970 INV37 SEC70 GINI, estimators adjusted for heteroscedasticity (White estimator). Column (3): as before, estimators adjusted for heteroscedasticity (Huber estimator). Columns (4) and (5): as before, but sub-samples of rich countries (Column 4) and poor countries (Column 5). A country is defined rich if its income per-capita is higher than the mean of the sample. Columns (6), (7), (8) and (9): as before; Latin American countries dropped in Column (6), African countries are dropped in Column (7), South East Asian countries are dropped in Column (8) and former Socialist countries are dropped in Column (9). Column (10): as before, selected sample.

Table 5 - Alternative Income Definitions

GROWTH	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Constant	0.0409	0.0409	0.0469	0.0469	0.0233	0.0233	0.0213	0.0213
	[1.865]	[2.109]	[2.077]	[2.046]	[1.152]	[1.133]	[0.984]	[0.967]
INCPC	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001
	[-2.916]	[-3.234]	[-2.405]	[-2.652]	[-2.632]	[-2.762]	[-2.257]	[-2.355]
INVEST	0.1343	0.1343	0.1321	0.1321	0.1238	0.1238	0.1201	0.1201
	[3.040]	[3.641]	[2.619]	[2.920]	[2.590]	[2.285]	[2.460]	[2.166]
HUMCAP	0.0001	0.0001	-0.0001	-0.0001	0.0002	0.0002	0.0002	0.0002
	[0.554]	[0.752]	[-0.374]	[-0.493]	[0.807]	[1.261]	[0.710]	[1.024]
INEQ	**-0.0010**	**-0.0010**	**-0.0009**	**-0.0009**	**-0.0005**	**-0.0005**	**-0.0005**	**-0.0005**
	[-2.779]	**[-2.510]**	**[-2.524]**	**[-2.350]**	**[-1.879]**	**[-1.524]**	**[-1.556]**	**[-1.262]**
Obs.	42	42	28	28	41	41	37	37
R^2	0.4483	0.4483	0.4148	0.4148	0.3516	0.3516	0.3100	0.3100
F	7.52	5.27	4.08	3.66	4.88	3.06	3.59	2.41

Notes: OLS estimators; t-statistics in brackets. Variables used are GR7089, GDP1970, INV37, SEC70 and GINI. In Column (1) and Column (2) only household data are considered and Column (2) is adjusted for heteroscedasticity (White estimator). In Column (3) and (4) only household gross incomes are considered and Column (4) is adjusted for heteroscedasticity (White estimator). In Column (5) and (6) only individual incomes are considered and Column (6) is adjusted for heteroscedasticity (White estimator). In Column (7) and (8) only individual gross incomes are considered and Column (8) is adjusted for heteroscedasticity (White estimator).

Table 6 - Alternative Inequality Measures

GROWTH	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Constant	0.0126	-0.0131	-0.0131	-0.0237	-0.0194	0.0378	-0.0221	0.0376
	[0.901]	[-1.399]	[-1.299]	[-1.542]	[-0.968]	[1.360]	[-1.581]	[1.682]
INCPC	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001
	[-3.450]	[-2.582]	[-2.895]	[-3.345]	[-2.995]	[-3.286]	[-3.274]	[-3.222]
INVEST	0.1371	0.1411	0.1492	0.1546	0.1543	0.1361	0.1415	0.1282
	[3.989]	[3.134]	[3.200]	[3.281]	[2.885]	[2.688]	[2.848]	[2.618]
HUMCAP	0.0002	0.0001	0.0001	0.0001	0.0002	0.0001	0.0001	0.0001
	[0.892]	[0.206]	[0.312]	[0.420]	[0.680]	[0.356]	[0.526]	[0.202]
INEQ	**-0.0003**	**0.0031**	**0.0010**	**0.0019**	**0.0006**	**-0.0006**	**0.6495**	**-0.0007**
	[-2.247]	**[2.397]**	**[1.802]**	**[1.487]**	**[0.789]**	**[-1.651]**	**[1.585]**	**[-2.103]**
Obs.	62	35	35	35	35	35	35	35
R^2	0.3740	0.4670	0.4270	0.4086	0.3779	0.4179	0.4141	0.4466
F	8.51	6.57	5.59	5.18	4.56	5.38	5.30	6.05

Notes: OLS estimators; t-statistics in brackets. Variables used are: GR7089, GDP1970, INV37, SEC70. INEQ is measured by RANKGINI (the ranking of Gini index) in Column (1); Q1, the percentage of income accruing to the bottom quintile of population in Column (2); Q1Q2, the percentage of income accruing to the bottom 40% of population in Column (3); Q3, the percentage of income accruing to the middle 20% of population in Column (4); Q3Q4, the percentage of income accruing to the 3rd and 4rd quintile of population in Column (5); Q5, the percentage of income accruing to the top quintile of the population in Column (6) and Q1Q5, the ratio between the bottom and the top quintile of population in Column (7). In Column (8) GINI is the measure of inequality but only the sub-sample of countries for which data on the quintiles distribution is available, is considered.

Table 7 - Alternative Ways of Measuring variables

GROWTH	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**
Constant	0.0162	0.0285	0.0245	0.0315	0.0315	0.0301	0.0126	0.0209	0.0185	0.0444
	[0.853]	[1.721]	[1.529]	[1.975]	[2.312]	[1.806]	[0.667]	[1.280]	[1.109]	[2.622]
INCPC	-0.0001	-0.0004	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001
	[-2.807]	[-3.554]	[-2.531]	[-3.286]	[-2.001]	[-4.030]	[-2.059]	[-3.193]	[-3.169]	[-4.603]
INVEST	0.1875	0.1519	0.1900	0.1424	0.1355	0.1430	0.1447	0.1502	0.1470	0.1318
	[4.789]	[4.280]	[5.328]	[4.097]	[3.735]	[3.987]	[3.748]	[4.463]	[4.322]	[4.028]
HUMCAP	-0.0001	0.0002	0.0001	-0.0001	-0.0007	0.0002	0.0001	0.0002	0.0002	0.0001
	[-0.474]	[0.829]	[0.539]	[-1.287]	[-0.489]	[1.033]	[0.171]	[0.916]	[0.900]	[0.821]
INEQ	**-0.0006**	**-0.0004**	**-0.0009**	**-0.0006**	**-0.0007**	**-0.0006**	**-0.0004**	**-0.0005**	**-0.0005**	**-0.0009**
	[-2.083]	**[-1.817]**	**[-3.822]**	**[-2.555]**	**[-2.900]**	**[-2.653]**	**[-1.314]**	**[-2.068]**	**[-1.978]**	**[-3.771]**
POLINST						-0.0169				
						[-1.028]				
FERT							0.0002			
							[0.074]			
REDISTR								-0.0002	-0.0001	0.0020
								[-0.866]	[-0.313]	[0.083]
Obs.	55	62	58	62	62	61	59	58	58	45
R^2	0.4100	0.3789	0.4669	0.3779	0.3625	0.4289	0.3453	0.3982	0.3907	0.5756
F	8.69	8.69	11.60	8.66	7.13	8.26	5.59	6.88	6.67	10.58

Notes: OLS estimators; t-statistics in brackets. OLS estimators. Variables used are GR7089, GDP1970, INV37, SEC70 and GINI unless otherwise specified. In Column (1) the dependant variable is GRWB7090 and INCPC is GNPPC70. In Column (2): INCPC is measured using the ranking of GDP1970. In Column (3): INVEST is measured by INV7489. In Column (4): HUMCAP is measured by PRI70. In Column (5): HUMCAP is measured by HUM70. In Column (6) POLINST is measured by PINS7080. In Column (7) FERT is measured by FERT70. In Column (8), (9) and (10) REDISTR is measured by EXP7090 (Column 8), TR7090 (Column 9) and TAX7489 (Column 10).

Table 8 - Alternative Time Periods

GROWTH	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Constant	0.0856 [3.462]	0.1336 [5.488]	-0.0067 [-0.272]	-0.0019 [-0.055]	-0.0058 [-0.231]	0.0783 [2.442]	-0.0058 [-0.285]	-0.0772 [-3.194]	0.0258 [0.392]
INCPC	-0.0001 [-2.729]	-0.0001 [-2.911]	-0.0001 [-1.902]	-0.0001 [-1.063]	0.0001 [0.211]	-0.0001 [-2.027]	0.0001 [0.174]	-0.0001 [-0.379]	-0.0001 [-0.257]
INVEST	0.2447 [4.803]	0.0284 [0.550]	0.0020 [3.568]	0.0010 [1.368]	0.0017 [3.303]	-0.0001 [-0.211]	0.0018 [4.523]	0.0020 [3.576]	0.0018 [3.383]
HUMCAP	0.0001 [0.427]	0.0001 [0.231]	0.0003 [1.121]	0.0003 [0.733]	0.0001 [0.181]	0.0002 [1.309]	0.0001 [0.193]	0.0001 [0.086]	-0.0001 [-0.014]
INEQ	**-0.0013** **[-3.384]**	**-0.0006** **[-1.756]**	**-0.0002** **[-0.601]**	**0.0008** **[1.548]**	**-0.0006** **[-1.631]**	**-0.0006** **[-1.582]**	**-0.0006** **[-1.769]**	**0.0031** **[2.176]**	**-0.0012** **[-2.369]**
POLINST		-0.0021 [-0.890]		0.0021 [0.658]		0.0033 [1.398]			
FERT		-0.0104 [-3.927]		-0.0061 [-1.567]		-0.0076 [-2.461]			
CAPMARK		0.0207 [1.308]		-0.0094 [-0.334]		0.0016 [0.129]			
REDISTR		0.0002 [0.722]		0.0001 [0.051]		-0.0004 [-1.225]			
LAAM		0.0121 [1.443]		-0.0200 [-1.602]		-0.0318 [-3.836]			
AFRI		0.0261 [1.933]		-0.0057 [-0.321]		-0.0010 [-0.069]			

(Table 8 – continued)

GROWTH	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**
SEAS		0.0438 [4.526]		0.0178 [1.270]		0.0153 [1.536]			
SOCI		Dropped		Dropped		-0.0406 [-2.259]			
Obs.	55	49	53	43	51	41	51	42	42
R^2	0.5143	0.7886	0.2358	0.4352	0.2994	0.7392	0.2994	0.3258	0.3396
F	13.23	12.55	3.70	2.17	4.91	6.61	9.39	4.47	4.76

Notes: OLS estimators; t-statistics in brackets. Columns (1) and (2): 25-year period, from 1970 to 1995. Series used are WBGR7095, GNPPC70, INV37, SEC70, GINI, PRIGHTSB, FERT70, M270, TR7095, LAAM, AFRI, SEAS and SOCI. Columns (3) and (4), 10-year period from 1970 to 1980. Series used are: GR7080 GDP1970 INV7080 SEC70 GINI PRIGHT34 FERT70 M270 TR7080 LAAM AFRI SEAS SOCI. Columns (5) and (6), 10-year period from 1980 to 1990. Series used are: GR8089 GDP1980 INV8090 SEC80 GINI PRIGHT56 FERT80 M280 TR8090 LAAM AFRI SEAS SOCI. Column (7): as Column (5) but robust estimators. Column (8): as Column (5) but INEQ is measured by Q3. Column (9): as Column (5) but INEQ is measured by Q5.

Table 9 - The Political Economy Model

	(1) GROWTH	(2) REDISTR	(3) REDISTR	(4) GROWTH	(5) GROWTH	(6) INVEST	(7) INVEST	(8) GROWTH	(9) INEQ	(10) INEQ
Constant	0.0219	28.578	0.3698	-0.0115	-0.0151	0.1079	0.1520	-0.0101	60.071	7.1218
	[1.536]	[3.373]	[2.015]	[-1.887]	[-2.134]	[3.336]	[5.258]	[-1.806]	[20.564]	[5.491]
INCPC	-0.0001	0.0007	0.0001	-0.0001	-0.0001			-0.0001		
	[-3.691]	[1.436]	[0.502]	[-2.777]	[-2.304]			[-3.272]		
INVEST	0.1370			0.1632	0.1934			0.1643		
	[4.054]			[4.917]	[4.467]			[5.213]		
HUMCAP	0.0002			0.0003	0.0002	0.0094	0.0087	0.0003	-2.3673	0.7226
	[1.411]			[1.784]	[0.981]	[2.168]	[2.629]	[2.075]	[-6.826]	[5.894]
INEQ	**-0.0005**	**-0.2554**	**-0.0003**							
	[-2.143]	**[-1.697]**	**[-0.816]**							
DEM	0.0053	2.4121	0.0925							
	[0.922]	[0.902]	[1.148]							
REDISTR				0.0001	-0.0043	0.0005	0.0314		-0.2402	0.1218
				[0.171]	[-0.673]	[0.444]	[1.686]		[-2.419]	[2.771]
CAPMARK						0.1720	0.1026			2.8620
						[3.167]	[3.502]			[1.353]
POLINST						-0.0019	-0.0061		-23.899	13.264
						[-0.389]	[-1.395]		[-1.987]	[2.376]
Obs.	62	58	47	58	47	53	46	58	51	27
R^2	0.3814	0.3223	0.1563	0.3448	0.3231	0.4742	0.5430	0.3186	0.5198	0.6322
F	5.89	9.53	2.93	7.70	6.87	10.01	13.76	10.58	23.30	14.44

Notes: OLS robust estimators; t-statistics in brackets. Variables used are GR7089, GDP1970, INV37, SEC70 and Gini unless otherwise specified. In Column (1) DEM is a dummy for democracy built assigning a value of 1 to countries with a value of the Gastil index of political rights (PRIGHTSB in this paper) lower than or equal to 3. In Column (2) the dependant variable is TR7090. In Column (3) the dependant variable is MARTAX. In Column (4) REDISTR is measured by TR7090 and in Column (5) by MARTAX. INV37 is the dependant variable in Column (6) and (7) in which REDISTR is measured respectively by TR7090 and MARTAX, HUMCAP is measured by HUMAN70 rather than SEC70 and CAPMARK is measured by M270. In Columns (9) and (10) INEQ is measured by GINI and Q3 respectively. In Columns (9) and (10) REDISTR is measured by TR3, HUMCAP by HUMAN70, POLINST by PINSTAB3 and CAPMARK by M270.

Table 10 - The Capital Market Imperfections Model

	(1) GROWTH	(2) HUMCAP	(3) HUMCAP	(4) GROWTH	(5) REDISTR	(6) REDISTR	(7) HUMCAP	(8) HUMCAP
Constant	0.0370	22.932	6.0446	-0.0101	28.5778	0.3698	5.1141	1.9606
	[2.926]	[2.318]	[4.406]	[-1.806]	[3.373]	[2.015]	[1.394]	[3.436]
INCPC	-0.0001	0.0028	0.0006	-0.0001	0.0007	0.0001	0.0033	0.0006
	[-3.519]	[4.686]	[6.416]	[-3.272]	[1.436]	[0.502]	[5.716]	[7.602]
INVEST	0.1075			0.1643				
	[3.267]			[5.213]				
HUMCAP				0.0003				
				[2.075]				
INEQ	**-0.0008**	**-0.3192**	**-0.0712**		**-0.2554**	**-0.0028**		
	[-3.394]	**[-1.919]**	**[-3.014]**		**[-1.697]**	**[-0.816]**		
CAPMARK	0.0151	-7.504	-1.7691				-4.6001	-1.4249
	[1.731]	[-0.797]	[-1.342]				[-0.443]	[-0.993]
DEM					2.412	0.0925		
					[0.902]	[1.148]		
REDISTR							0.0463	0.0168
							[0.263]	[0.958]
Obs.	57	54	54	54	62	50	52	52
R^2	0.4612	0.5230	0.7637	0.3186	0.3223	0.1563	0.5181	0.7184
F	9.37	23.41	106.49	10.58	9.53	2.93	22.40	48.10

Notes: OLS robust estimators; t-statistics in brackets. Variables used are GR7089, GDP1970, INV37, SEC70, GINI unless otherwise specified. CAPMARK is measured by M270 and DEM is a democracy dummy. In Column(3) HUMCAP is measured by HUMAN70. In eq (5) the dependant variable is TR7090 and in Column (6) is MARTAX. In Column (7) the dependant variable is SEC70 and REDISTR is measured by TR7090. In Column (8) the dependant variable is HUMAN70 and REDISTR is measured by EXP7090.

Table 11 - The Integrated model

	(1) GROWTH	(2) REDISTR	(3) REDISTR	(4) REDISTR	(5) GROWTH	(6) GROWTH	(7) GROWTH	(8) GROWTH
Constant	0.0185 [1.202]	40.360 [4.874]	77.247 [4.174]	68.6146 [3.693]	0.0240 [2.023]	0.0074 [0.431]	0.0678 [4.165]	0.0344 [1.861]
INCPC	-0.0001 [-2.859]	0.0004 [0.740]	0.0002 [0.378]	0.0007 [1.420]	-0.0001 [-1.920]	-0.0001 [-1.322]	-0.0001 [-3.434]	-0.0001 [-2.8887]
INVEST	0.1470 [4.166]							
HUMCAP	0.0002 [1.178]							
INEQ	**-0.0005** **[-1.883]**	**-0.2213** **[-1.593]**	**-2.0656** **[-2.778]**	**-2.0670** **[-2.708]**			**-0.0009** **[-3.551]**	**-0.0009** **[-3.178]**
INEQSQ			**0.0209** **[2.684]**	**0.0204** **[2.534]**				
REDISTR	-0.0008 [-0.314]				-0.0010 [1.015]	0.0012 [1.171]	0.0017 [1.922]	0.0018 [1.848]
REDISTRSQ					-0.0001 [-0.704]	-0.0001 [-0.791]	-0.0001 [-2.049]	-0.0001 [-1.985]
POLINST		-8.0103 [-2.604]	-8.6451 [-3.251]	-0.3645 [-0.537]	-0.0039 [-2.319]	0.0047 [0.627]	-0.0038 [-2.363]	0.0122 [2.702]
POLINSTSQ		1.0880 [2.703]	1.1220 [3.176]			-0.0012 [-1.242]		0.0194 [3.203]
Obs.	58	63	63	63	62	62	62	62
R^2	0.3907	0.3649	0.4390	0.3833	0.1129	0.1267	0.3016	0.2724
F	5.53	9.57	8.66	7.21	1.68	2.53	7.41	12.55

Notes: OLS robust estimators; t-statistics in brackets. Variables used are GR7089, GDP1970, INV37, SEC70 and GINI unless otherwise specified. INEQSQ, REDISTRSQ and POLINSTSQ are the squared terms of the correspondent variables. REDISTR is measured by TR7090 throughout the table; no substantial change appears when EXP7090 is used instead. POLINST is measured by PRIGHTSB.

Table 12 - The Socio-Political Instability Model

	(1) GROWTH	(2) POLINST	(3) POLINST	(4) GROWTH	(5) GROWTH
Constant	0.0417	6.2032	1.0306	0.0010	0.0269
	[2.937]	[5.395]	[1.036]	[0.104]	[2.549]
INCPC	-0.0001	-0.0004		-0.0001	-0.0001
	[-4.199]	[-5.058]		[-3.796]	[-2.257]
INVEST	0.1374			0.1675	
	[4.242]			[5.580]	
HUMCAP	0.0001	-0.0303		0.0003	0.0028
	[1.109]	[-0.0268]		[1.993]	[1.896]
INEQ	**-0.0006**	**-0.0268**	**0.0511**		
	[-2.705]	**[-1.398]**	**[2.456]**		
POLINST	-0.0032			-0.0025	-0.0023
	[-1.942]			[-1.444]	[-1.224]
Obs.	62	63	69	62	62
R^2	0.4115	0.5227	0.0907	0.3400	0.0713
F	7.20	35.54	6.03	9.01	1.86

Notes: OLS robust estimators; t-statistics in brackets. Variables used are GR7089, GDP1970, INV37, SEC70, GINI and PRIGHTSB. HUMCAP in Column (2) is measured by HUMAN70.

Table 13 - The Fertility Model

	(1) GROWTH	**(2) FERT**	**(3) FERT**	**(4) GROWTH**	**(5) GROWTH**	**(6) HUMCAP**	**(7) HUMCAP**	**(8) GROWTH**
Constant	0.0432 [1.993]	3.3794 [2.627]	4.3602 [4.999]	0.0295 [1.485]	0.0195 [1.110]	6.5482 [5.679]	0.6088 [6.568]	-0.0104 [-1.917]
INCPC	-0.0001 [-3.526]	-0.0002 [-3.057]	-0.0003 [-5.366]	-0.0001 [-3.571]	-0.0001 [-2.844]	0.0004 [4.106]	0.0001 [4.295]	-0.0001 [-3.122]
INVEST	0.1073 [2.281]			0.1096 [2.389]	0.1029 [2.753]			0.1346 [3.955]
HUMCAP		-0.2009 [-1.500]			0.0007 [0.541]			0.0003 [2.167]
INEQ	**-0.0005** **[-2.146]**	**0.0650** **[3.441]**	**0.0486** **[3.188]**					
CAPMARK			-2.135 [-2.948]		0.0121 [1.055]	-3.1360 [-2.535]	0.1816 [1.865]	0.0171 [1.794]
FERT	-0.0027 [-1.096]			-0.0049 [-2.015]	-0.0040 [-1.724]	-0.6174 [-3.769]	-0.0801 [-6.916]	
Obs.	63	60	57	60	53	53	53	53
R^2	0.3798	0.7578	0.7576	0.3404	0.3981	0.8105	0.8368	0.3691
F	7.18	73.95	74.92	10.71	7.21	94.92	91.52	9.60

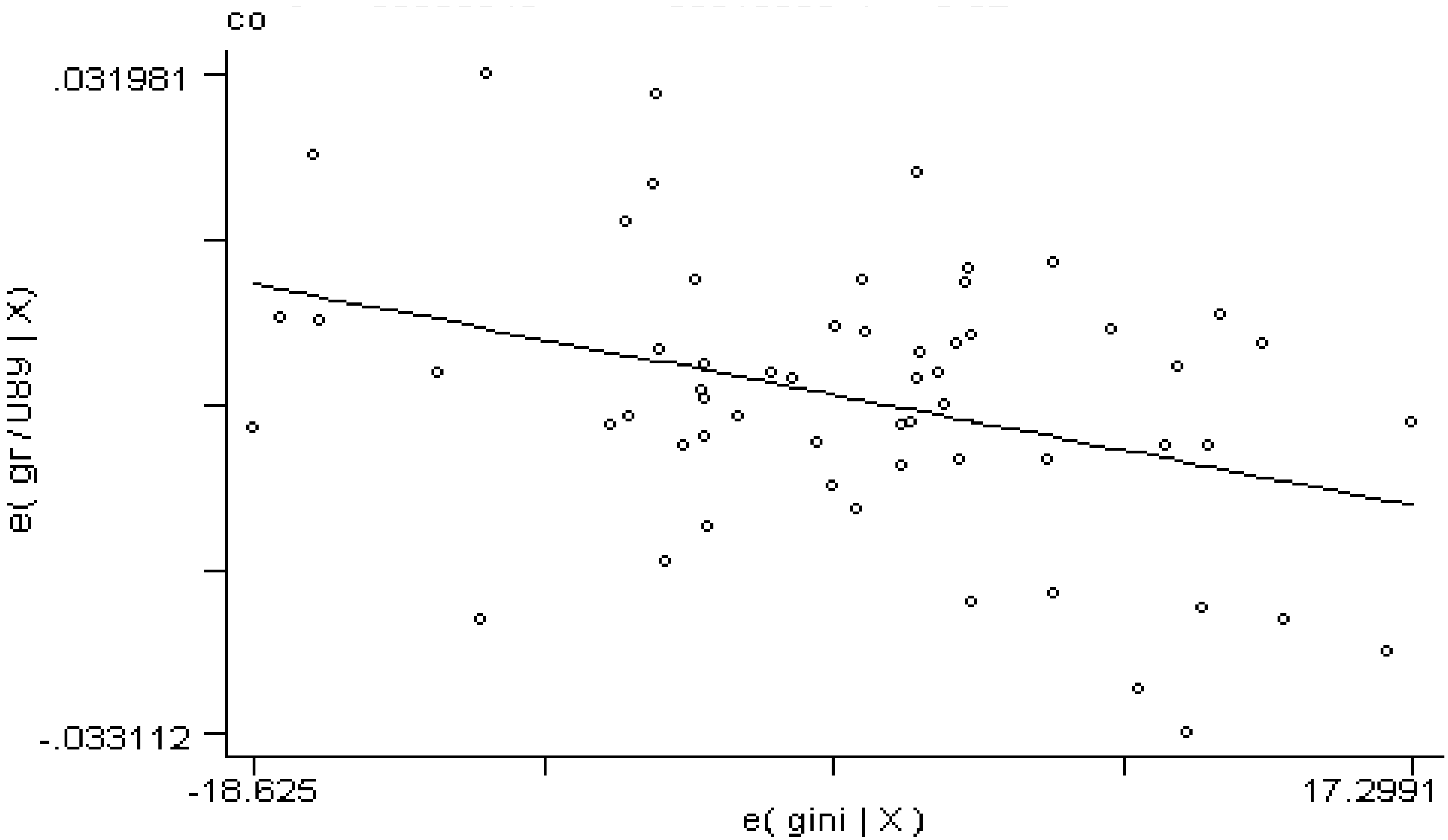
Notes: OLS robust estimators; t-statistics in brackets. Variables used are GR7089, GDP1970, INV37, SEC70, GINI, M270 and FERT70 unless otherwise specified. HUMCAP is measured by HUMAN70 in Column (2), (3) and (6) and by S70 in Column (7).

Table 14 - Summary of present findings

Model		Link	Validation
Reduced Form	Theory Empirical	INEQ - GROWTH INEQ - GROWTH	 ✓
PE	Theory Empirical	INEQ + REDISTR - GROWTH INEQ **(-)** REDISTR **(?)** GROWTH	 x
CM	Theory Empirical Theory (2) Empirical (2) Theory (3) Empirical (3)	CM + GROWTH CM **(+)** GROWTH INEQ + REDISTR + GROWTH INEQ **(-)** REDISTR **(?)** GROWTH INEQ - HUMCAP + GROWTH INEQ - HUMCAP + GROWTH	 (✓) x ✓
REDISTRIBUTION	Theory Empirical	REDISTR - INEQ REDISTR - INEQ	 ✓
BÉNABOU	Theory Empirical Theory (2) Empirical (2)	INEQ -,+ REDISTR +,- GROWTH INEQ -,+ REDISTR **(+,-)** GROWTH WEALTH +,- GROWTH WEALTH **(+,-)** GROWTH	 (✓) (✓)
PI	Theory Empirical	INEQ + POLINST - GROWTH INEQ **(?)** POLINST **(-)** GROWTH	 x
FERT	Theory Empirical	INEQ + FERT - GROWTH INEQ + FERT - GROWTH	 ✓

Notes: the first part of each row refers to the expected sign between the variables according to the theoretical models. The second part refers to the empirical findings of this paper. In the third column, signs into parenthesis mean that the coefficients are not significant at the 5% level. ? means that no clear conclusion can inferred. In the last column, "x" means that the theory is not validated by the data, "✓" means that the theory is validated and "(✓)" means that the evidence is not fully significant.

Fig. 1 – Scatter Plot of the Relationship between Inequality and Growth, as it is from Column 1 of Table 3



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