Cross-section evidence on the positive and negative effects of income inequality on economic growth

(Preliminary version)

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Abstract

The effects of income inequality on economic growth are somehow controversial. In fact, the literature suggests different transmission channels through which income inequality is likely to influence growth, sometimes in a positive way, other times in a negative way. While most empirical evidence supports a negative link, other authors show a positive effect, usually associated to short-run growth. However, negative and positive simultaneous impacts - associated to the different channels and different components of inequality related to these channels - have not been yet empirically analyzed for long-run growth. In this work, we revise the different transmission channels of inequality on growth and, using cross-section data and a simple system of recursive equations, we show, in a single model, the two differentiated impacts - a positive and negative one - of income inequality on long-run economic growth.

Keywords: inequality, growth
JEL classification: O1, O4, R1

I. INTRODUCTION

Much has been said about the effects of income inequality on economic growth. The ongoing debate rotates around possible negative as well as positive effects of inequality on growth given the complex nature of both phenomena. One factor seems to be of major relevance; whether inequality is due to available opportunities and particular socio-economic and institutional contexts, or due to market dynamics and unequal outcomes - and uneven success. The World Bank World Development Report 2006 (WDR 2006) differentiates *equality of opportunities* with *equality of outcomes* as two parallel and differentiated components of inequality. While unequal opportunities are detrimental for development, unequal outcomes generate necessary incentives for capital accumulation, innovation and economic growth; "inequality of opportunity is wasteful and inimical to sustainable development and poverty reduction" but there is an "important role of income differences in providing incentives to invest in education and physical capital, to work hard, and to take risks (WDR 2006)." In a similar fashion to that of the WDR 2006, William Easterly (2007) refers to "*structural inequality*" - due to socio-institutional factors - and to "*market inequality*" - due to market forces. While the former relates to uneven success in free markets, the latter relates to bad institutions, low human capital investment and underdevelopment. *Structural inequality* is expected to have a negative effect on subsequent economic growth, while *market inequality* is expected to have a positive effect.

Beyond the possibility of and overall positive and negative effect of inequality, the overall impact of inequality on economic growth is thought to be the given through different transmission channels already widely explained by the literature. Nevertheless, the complex influence of inequality on the dynamics of economic growth has regained special consideration after the world financial and economic crisis of 2008. The crisis has lead to several authors to put a strengthen emphasis on the role of inequality, and its rising levels in many countries, not just as a consequence, but also as a cause of the crisis itself (Stiglitz 2009; Brescia 2010; Rajan 2010; Krugman 2012). According to these authors, high levels of inequality help to explain manifested deficiencies in terms of economic performance and that have accumulated over the long run.

In this paper, following the literature on the different transmission channels for inequality to have an effect on growth, and the idea of differentiated components of inequality, we use several instruments - that we relate to the different transmission channels - to try to identify the effect of each channel and, hence, capture different components of the overall impact of inequality on long-run growth. Our aim is to provide further empirical evidence on the relevance of the different transmission channels through which inequality operates. In particular, our contribution is, by controlling the mechanisms that give raise to a negative effect of inequality, to distinguish, in a single econometric growth model, a simultaneous negative and positive effect of income inequality on long-run economic growth.

The paper is organized as follows. In the next section we briefly revise the theory and literature on the effects of income inequality on economic growth and the empirical evidence for the different transmission channels for this effect to happen. In section III we set our model, describe our data and set our empirical strategy. In section IV we present our estimation technique and results. In section V we perform some robustness checks. Finally, section VI concludes.

II. The different effects of income inequality on economic growth: Theory and literature review

The literature provides theoretical justifications for both a potential beneficial and a potential adverse effect of inequality on the process of economic growth. In particular, while classical and neoclassical approaches underlined a beneficial effect of inequality on growth, modern perspectives have highlighted potential adverse effects of inequality (Galor 2009). Among these modern perspectives, up to five differentiated approaches have been identified to try to explain the mechanisms through which inequality has an impact on long-run growth, namely the socio-political instability approach, the political economy approach, the capital market imperfections approach, the domestic market size approach and the approach of endogenous fertility. But even some these modern perspectives embody the possibility of a dual effect of inequality on the growth process. As our empirical aim focuses on identifying differentiated negative and positive effects, we next summarize first how the different approaches predict a negative effect of inequality, to then summarize how the possibility of a positive effect is also predicted.[1]

The negative effects of inequality on growth:

In short, this is how each of the five approaches predict a negative effect of high inequality on long-run economic growth: 1) one main transmission channel is through increased socio-political instability and risk of violent conflict, which translates into uncertainty of property rights and reduces investment and growth (Alesina and Perroti 1996). Additionally, stability-threatening activities represent an unproductive waste of resources and reduce the overall productivity of an economy (Barro 2000). 2) According to the political economy approach, either high inequality leads to higher redistributive pressure, which in turns may lead to economic distortions and disincentives (Alesina and Rodrik 1994; Persson and Tebellini 1994), or leads the rich to lobby to prevent efficient redistribution policies from being implemented (Saint-Paul and Vardier 1996; Banabou 2002).[2] These lobbying activities represent a waste of resources associated to rent

[1] Ehrarht (2009) and Galor (2009) both present a short, though exhaustive and comprehensive, overview of the theories and empirical evidence on the relationship between inequality and economic development.

[2] Sanit Paul and Verdier (1996) challenge the conventional political economy approach and argue that in fact unequal societies redistribute less and that this is in turn detrimental to growth.

seeking and corruption and precisely characterize what several authors have highlighted as the fundamental adverse role of inequality in the current global crisis (Stiglitz 2009; Krugman 2012). 3) In a different way, the credit-market imperfections approach predicts that higher inequality reduces the capacity of many individuals to invest when capital markets are imperfect and set up costs are large. On one side this increases macroeconomic volatility (Aghion, Caroli and Peñalosa 1999), while on the other hand it reduces average investment - especially in human capital (Galor and Zeira 1993). Both things lower long-run growth. 4) The market size approach emphasizes the relevance of the middle class and the risks of lower aggregate demand, derived from a higher proportion of population with lower purchasing power and the fact that lower income groups tend to have higher propensity to demand local products (Todaro 1997). 5) Finally, the endogenous fertility approach highlights the link between higher inequality and higher fertility rates, which in turn reduce growth. In particular, this happens given that as the number of children per family increases the average investment in education decreases (Barro 2000; Ehrhart 2009).

The positive effects of inequality on growth:

In parallel to the predicted negative effects, the literature also predicts possible positive effects of inequality through different mechanisms. The first one of these mechanisms relates to a presumed greater propensity to save among the rich embodied in classical and neoclassical models of growth. In this line, an increase in inequality leads to higher aggregate savings and therefore to higher levels of investment and growth (Kaldor 1956), this effect being lower according to the openness of the economy. Moving into the modern perspectives, a second, but related, mechanism relies on the existence of large set up costs or investment indivisibilities assumed in the capital market imperfections approach. Under these investment indivisibilities higher inequality again allows for greater aggregate investment (Aghion, Caroli and Peñalosa 1999). Moreover, unifying the classical and modern perspectives, Galor and Moav (2004) suggest a changing relationship between inequality and growth that depends on the process of development; inequality being growth-enhancing in early stages, adverse afterwards in that process, and irrelevant in developed economies.[3] Finally, differentiating inequality of outcomes from inequality of opportunities, both classical and modern perspectives acknowledge a growth enhancing effect of inequality of outcomes. A growth enhancing effect associated to incentives for capital accumulation (Galor 2009) and for innovation (Mirrlees 1971), as to incentives to work hard and take risks (WDR 2006).[4]

[3] In particular, in early stages of development, when physical capital accumulation is the prime engine for growth, inequality can enhance the process of development by channelling resources towards individuals whose marginal propensity to save is higher, allowing for higher levels of investment. In later stages of development, however, when human capital accumulation becomes the prime engine for growth, and given credit constraints, higher inequality leads to a lower spread of education among individuals, handicapping the process of development due to diminishing returns of human capital. Finally, as capital markets develop and credit constrains are relaxed, inequality becomes irrelevant.

[4] Barro (2000) provides a good understanding of how some approaches can predict at the same time a negative and a positive effect on growth. As Barro notes, even under the socio-political instability approach, lower inequality may not lead to higher growth. If economic resources are required for the poor to effectively threaten the socio-political stability, then income-equalizing

Examining each transmission channel: brief summary of empirical evidence

The above transmission channels have been all described in the related literature but mostly in a theoretical way. When it comes to the empirical evidence, the traditional econometric approach in the literature has been to introduce a single measure of income distribution in an economic growth model to capture the overall impact of inequality on growth, but without empirically identifying how this impact is transmitted via each of the channels.[5] In this line of the literature, there is evidence, a priori seemingly confronted, of an overall negative impact as there is of an overall positive impact. On one hand, and based on cross-section analysis, several authors support the idea of a negative effect of inequality on long-run growth (Alesina and Rodrik, 1994; Persson and Tabellini, 1994; Clarke, 1995; Perotti, 1996; and Easterly, 2007). By contrast, on the other hand other authors find a positive impact (Forbes 2000; Barro 2000; Chen 2003 and Voitchovsky 2005). However, the positive impact relies in panel data analysis and is either associated to short-term economic growth (Forbes 2000) or is dependent on countries' income (Barro 2000), on initial income distribution itself (Chen 2003), on the profile of inequality (Voitchovsky 2005), or on the process of urbanization (Castells-Quintana and Royuela 2011). Panel techniques allow to controls for time-invariant factors, but removing these factors, which are precisely those to which structural inequality - and a likely negative effect of it on growth - is associated to, limits the possibility of empirically assessing the role of different mechanisms behind the impact of inequality on growth. And, to the best of our knowledge, no work yet provides evidence of a positive effect of inequality using cross-section data on long-run growth.

Given data constrains and the difficult task of measuring each channel separately, very few works have attempted at empirically and independently asses each of the different transmission channels through which inequality has a positive influence on growth in some cases, but a negative in others. In fact, despite extensive evidence, a comprehensive empirical analysis and examination of the several transmission channels is still missing in the literature. Some works have, however, tried to analyse the dynamics of a single approach. The aim of these works is to first see the effect of inequality on a given variable, as a proxy for the channel under analysis, to then see the effect of this variable on growth (or variables that we now are relevant for growth, like investment). A table in the appendix lists the main papers providing empirical evidence for the different channels, the variables they use as proxy for the channel, and the effect they find either on growth or investment. A relevant work is that of Alesina and Perotti (1996). They provide evidence on the effect of inequality on an index for Socio-Political Instability (SPI),

transfers promote stability only to the extent that that they do not encourage the poor to involve in disruptive actions rather than work.

[5] The most used measures are Gini coefficients and Theil indices. Some authors have also worked with different shares and ratios of the percentiles along the whole distribution of income. On one side, the percentage of the third quartile has been of particular interest to capture the weight of the middle class; given the idea that having a strong middle class boosts economic development (Easterly 2001; Partridge 2005). On the other side, the use of different percentile ratios has allowed to focus on differentiated effects depending on the specific distributional forms of income (Voitchovsky 2005).

constructed applying the method of principal components analysis to several variables, as evidence on the effect of this SPI index on investment. Perotti (1996) replicates a similar analysis of Alesina and Perotti (1996) but goes beyond and tries to test two more approaches aside the socio-political instability one, namely the Capital Market Imperfections (CMI) approach (using a loan-to-value payment for mortgages as a proxy for the degree of imperfections in the capital markets) and the Political Economy (PE) approach (using the share of government transfers in GDP as a proxy for redistribution). However, he does not consider the three channels in a single model. His results seem to support the Socio-Political Instability approach and the Capital Market Imperfections approach, but not the Political Economy approach. In a similar fashion to Alesina and Perotti, posterior works focus on liberties, institutions and the quality of property rights, as the main transmission channel within the socio-political instability approach (Svensson 98; Knack and Keefer 2000). Regarding the political economy approach, Persson and Tabellini (1994) consider welfare transfers (only for a sample of 13 OECD countries for which data was available) to find non-significant results about the prediction that inequality increases redistribution and that redistribution reduces growth. In fact, further evidence actually yields opposite results than those predicted by the approach. Concerning the role of the domestic market, on one hand Falkinger and Zweimmuller (1997) consider product diversity, while on the other hand Keefer and Knack (2000) consider variables related to population, aggregate GDP and openness. In both cases results are not conclusively supportive of the domestic market approach. However, several other authors have provided evidence of the relevance of the size of the middle class (Easterly 2001; Partridge 2005). Finally, regarding the endogenous fertility approach, several works provide evidence on the positive link between inequality and fertility rates (Perotti 1996; Koo and Dennis 1999; Kremer and Chen 2000) and a negative effect of fertility rates on growth (Barro 2000). Yet, even controlling for fertility, Barro finds a negative effect in poor countries and even a positive effect in rich countries.

Can we see both effects?

Works as Barro (2000), Chen (2003), Voitchovsky (2005), and Castells-Quintana and Royuela (2012) suggest that there can be indeed a negative and also a positive effect of inequality on economic growth. Nevertheless, the differentiated effect is not empirically related to any of the different channels through which inequality might affect growth, neither is there evidence of both effects happening at the same time. In fact, Chen (2003) finds a positive effect but as long as inequality levels are small, and he acknowledges that his "empirical model does not identify the channels through which initial inequality affects long-run economic growth". Voitchovsky (2005) does find a parallel positive and negative effects in a single model by using different parts of the income distribution; inequality at the top end of the distribution is positively associated with growth, while inequality lower down the distribution is negatively related to subsequent growth. However, the work also acknowledges that its empirical analysis "is not very informative regarding the different channels through which inequality might affect income." Easterly (2007) also suggest a negative and also a positive effect of inequality on growth, focusing on two differentiated components of inequality (*market inequality* and *structural inequality*). Though on the empirical

side he focuses only on *structural inequality*, expected to be captured using factor endowment differentials across countries as a central determinant of it - in particular, the exogenous suitability of land for wheat versus sugarcane, to find a long-run negative effect of inequality on development. A negative effect, which seems to work through lower investment in human capital, as in Perotti (1996), and through lower institutional quality (Easterly finds a significant negative effect of structural inequality on educational and institutional quality levels). Thus, Easterly makes no attempt at capturing *market inequality* and its relationship with economic development.

In sum, although the theory predicts possible differentiated effects through different channels and some authors acknowledge that inequality is likely to have at the same time a positive and a negative effect on economic growth, empirical evidence in this sense remains very limited. Few works have attempted at capturing the two opposing effects of inequality, but no work, as far as we know, has captured separately, in a single model, the differentiated effects suggested by each channel.

III. Empirical Approach

Empirical model and data

As we want to focus on long-run effects of income inequality on economic growth, we follow the literature on the determinants of cross-country differences on long-run growth. This literature tends to rely on OLS regressions of accumulated growth rates over initial values of explanatory variables, and results are interpreted as measuring the long-run effects of those variables on subsequent economic growth.[6] In particular we follow Sala-i-Martin et al. (2004) analysis on economic growth using cross-section data. Out of 67 possible explanatory variables, Sala-i-Martin et al. find 18 that are significantly related to long-run growth over 1960-1996. Results suggest that the main determinants for growth are levels of per capita GDP - the neoclassical idea of conditional convergence - and variables for natural resource endowments, physical and human capital accumulation, macroeconomic stability, and productive

[6] Binder and Georgiadis (2011) note that the predominant tool used in the empirical output growth literature continues to be the "Barro regression", using a cross section data set. They list up to four basic problems associated with these regressions: all cross country heterogeneities are assumed to be fully captured by the control variables; they are subject to endogeneity bias; there is no clear distinction between short and long run dynamics; and nonlinearities are not considered. All these arguments have been approached in the literature. The classification of countries and the introduction of interactions is a first strategy to deal with problems of heterogeneities and nonlinearities (Durlauf et al. 2005). Another strategy is the use panel data sets and techniques. In this line, in the empirical literature on the effects of inequality on economic growth, the majority of cross sectional studies has found a negative coefficient (Dominicis et al 2008). On the contrary, when panel data sets are considered, the negative effects disappears and even becomes positive when fixed effects or GMM methods are used. Partridge (2005) has criticised the used of fixed effects methods for the analysis of such relationship, as inequality is a highly persistent variable over time. Similarly, Barro (2000) maintains that fixed effects estimates exacerbate the bias due to measurement error. In our paper, we assume all potential criticisms and try to integrate into a cross section framework both the positive and negative effects of inequality on economic growth focusing on long-run dynamics (as we average growth over 37 years).

specialization (it is found a negative and significant effect of the fraction of primary exports in total exports). We follow Sala-i-Martin et al. (2004) and set a neoclassical econometric model of economic growth that includes, as controls, several of these relevant variables. In particular, we introduce in our model *life_exp* - the life expectancy at birth, *p60* - the primary enrollment rate, *yrsopen* - the number of years the economy has been open between 1950 and 1994, *primary_exports* - the fraction of primary exports in total exports, and *mining* - the fraction of GDP in mining - to capture natural endowments. Our growth equation then looks like (1), where *growth* is as our dependent variable, which reflects accumulated annual average per capita GDP growth rate, with data from Summers and Heston (Penn World Table – PWT), (y_{i0}) is initial income, for which we use *log_pcgdp* - the initial level of per capita GDP (in log), (I_{i0}) is income inequality, measured by the gini coefficient and (X) all the controls considered. The data, aside that for income inequality, come from Sala-i-Martin et al. (2004), the PWT and the World Bank Development Indicators database. For income inequality we rely on Gruen and Klasen (2008). (A table with the variables used and their sources is annexed). We use data as close to 1970 as possible to explain average growth rates between 1970-2007 in a sample of 51 countries (a list of which is also annexed).[7]

$$growth = c + \alpha(y_{i0}) + \beta 1(I_{i0}) + \gamma 1(X) + u_i \qquad (1)$$

Table 1 presents descriptive statistics for the variables used in the growth equation, while table 2 presents correlations among these variables. Growth is positively correlated with initial values of *life_exp*, *p60* and *yrsopen*. By contrast, growth is negatively correlated with initial values of *log_pcgdp*, *primary_exports*, *mining* and *inequality*. In fact, the highest negative correlation (-0.371) is with the latter. Regarding inequality and the controls, inequality is positively correlated with *mining* and *primary_exports* and negatively correlated with the other variables.

Table 1: Descriptive statistics: variables in the growth equation

Table 2: Correlations: variables in the growth equation

Figure 1 shows the scatter plot between initial inequality and accumulated annual average growth (1970-2007). It can be observed that countries with initial high inequality - Gini above 45 - presented low, or even negative, subsequent economic growth - generally lower than 2% - (countries like Madagascar, Morocco, Peru, Honduras or Nepal), while countries with initial low inequality presented higher long-run growth (countries like China, South Korea, Ireland and Egypt).

Figure 1: Correlation graph inequality and growth

[7] The selected countries are those for which reliable data for all the variables used here has been found. The sample includes major countries from all different world regions.

Differentiating countries by levels of GDP and levels of inequality (high and low compared the sample median), we find that among the initially low-GDP countries those with an initial Gini coefficient lower than the sample mean tended to grow more in the long run than those with initial Gini higher than the sample mean. In fact, out of 13 low-GDP countries that grew less than the median rate, 11 where initially unequal. But still, 5 low-GDP and initially unequal countries grew above the median (Malaysia, Panama, Thailand, Tunisia and Turkey). Interestingly, the first three are countries highly dependent on international trade.[8] Among the high-GDP countries, only one (Hong Kong) out of 8 of the initially unequal ones, and again a country highly dependent on international trade, grew above the median growth rate.

Empirical strategy

As we have seen, few previous works have tried to empirically assess the different transmission channels through which inequality has an impact on economic growth. One common strategy has been to use an intermediate variable as proxies representing the channel under analysis (as in Alesina and Perroti 96; Perotti 96). In parallel, and taking into account two differentiated components of inequality, giving rise to two differentiated effects on growth - one positive and one negative - a second approach has been to isolate one of those components using specific instruments for inequality (as in Easterly 2007). Both strategies, therefore, rely on the use of instrumental variables to capture a particular mechanism through which inequality has an effect on growth. However, in the first strategy each channel is considered independently and no attempt is made to examine all of them in a single growth model. In fact, as we have seen, very few papers empirically consider more than one channel. Similarly, in the second strategy only the structural component (giving rise to a negative effect of inequality on growth) is empirically considered. Building on both strategies, our goal is try to identify each of the different transmission channels and assess their effect on long-run economic growth. Moreover, we expect to decompose the impact of inequality and capture in a single growth model both effects, the negative and the positive.

To capture the dynamics behind each of the theoretical transmission channels through which inequality has a different impact on growth is a difficult task, as previous literature has highlighted, and one of the main reason why the empirical evidence is still far behind the theoretical work. We know that the transmission channels are very difficult to be measured quantitatively and precisely. However, the reviewed literature proposes several variables that can at least be related to inequality and to each of the channels under consideration. In this line, we believe we can try, although we recognize that it will be imprecisely, identify each channel and capture the differentiated effects of income inequality on long-run growth by using different instrumental variables related to the different transmission channels of inequality. By doing this, and as a contribution to the literature, we expect to empirically asses which mechanisms need to be controlled for in order to capture a possible positive effect of inequality differentiated from its negative effect.

[8] These countries could clearly be defined by a system of "Unequal Development" (Samir Amin); their economy is markedly split between a highly efficient and highly remunerated international sector and a lagged and poorly remunerated domestic sector.

Thus, our first stage is to generate two variables from each set of instruments: an estimated inequality and an estimated error term. As we are assuming that inequality has an effect on growth through different channels that can be associated to different components of this inequality (Easterly 2997; WDR 2006), this error term is expected to capture other components of inequality that are not associated with the variables used as instruments. In a second stage, by introducing both terms, inequality and the estimated residual, we can assess two differentiated effects of inequality on economic growth, which will depend on the instruments that we use for the estimated inequality each time. We base our econometric empirical framework on an extension of Wooldridge (2002). We present an explanation of this framework in the appendix.

IV. Estimation Technique and Results

Our approach is therefore based on recursive estimation. In a first equation we estimate income inequality using different instruments by transmission channel. In a second equation, and again for each set of instruments, we introduce inequality and the estimated residual from the first equation, along control variables, to estimate our model of long-run economic growth. It has to be acknowledged as well that our second estimated component of inequality (the estimated error term from the first equation) is likely to be endogenous in the growth equation. In any case, it allows us to distinguish a different relationship with economic growth of this component of inequality from the relationship with the estimated inequality from the instruments used.

For the purpose of our work, as instruments for inequality, and again taking into account the high data constrains we find, we look for variables related to inequality and that we could use to try to identity each of the different transmission channels that give rise to an effect on long-run growth. For socio-political instability we consider variables related to social unrest and violence, following the idea in Alesina and Perotti (1996). We follow a parsimonious strategy and select, among several variables positively correlated with inequality and negatively with growth, three variables that yield a higher R-squared in a regression for inequality.[9] For redistributive policies we use average government spending and average expenditure on education, both as share of GDP. For domestic market size and the role of the middle class we use aggregate GDP and the share of the third quintile in the income distribution (the role of foreign markets being already captured by having openness as one of the controls in the growth equation). For the role of endogenous fertility we consider fertility and infant mortality rates. We add to our list variables time-

[9] We also consider several other variables for social unrest and violence as robustness check in the estimations described in section 4. Aside social unrest and violence, other authors consider variables related to liberties, rights and institutions. However, most of these variables are measured at best after the 80s and are expected to by highly affected by economic performance. For our results we, therefore, stick to the selected variables as some of the most commonly used and to reduce endogeneity.

invariant variables expected to capture the *structural* component of inequality: the exogenous suitability of land for wheat versus sugarcane and the proportion of population in tropical areas - as considered by Easterly (2007) - and the proportion of mountainous lands.[10] Table 3 presents descriptive statistics for all these different variables, their correlation with income inequality and the results from the first stage estimations, in which we regress inequality on the instruments selected. (Definition and sources of the variables are found in the appendix.)

Table 3: First-stage results

As we can see, most of the variables selected to capture the different channels have some considerable correlation with inequality and many of them are individually significant in the first-stage. Thus, using instruments to capture structural inequality we capture up to 50 per cent of the variance in inequality. We can also consider all instruments that we relate to a negative component of inequality, in that case we capture up to 80 per cent of the variance in inequality. It is important to notice the relevance of structural factors driving this negative component of inequality. As these are mostly time-invariant factors they get cancelled out in panel data analysis with fixed effects or first differences, which, as we have seen, might help us explain results suggesting a positive effect of inequality when this type of analysis is performed.

For each set of instruments, we estimate the residual from the first-stage. This residual will capture, in each case, the remaining unexplained variance in inequality. Thus, for example, the residual from the first stage in which we consider all the instruments that relate to a negative component of inequality will capture the remaining 20 per cent of variance in inequality. As we consider different sets of instruments, we can analyze which factors need to be controlled for so our residual captures, among other things, a positive component of inequality significant in the growth equation (something that is not done in panel data analysis that suggest appositive effect of inequality).

Before we assess our two components in the growth equation, we can test to what extent our estimated inequality and our residual capture a negative and a positive component of inequality in the growth process based on the theory revised in section II. One simple and straight way is to see how the two components correlate with physical and human capital accumulation, innovation and institutional quality, as the theory on the effects of inequality on growth suggests that most of the effects of the former on the latter go finally through these variables. In this line, on one hand we expect our estimated *negative inequality*

[10] It is important to highlight the difference between the variables that we use for each transmission channel from the instruments for structural inequality. The latter are predetermined time-invariant exogenous variables expected to capture factor endowments. The rest of our variables are time-variant. In that line, we look for variables measured as close as possible to 1970 and that, although not predetermined, could be considered as exogenous in the growth equation. What we are trying to do, in accordance to the empirical strategy set in section III, is just to use them to capture specific and differentiated mechanisms in the impact of inequality on growth.

(that in which we consider all the different instruments associated to a negative effect) to be negatively correlated with the above-mentioned variables. Regarding physical capital accumulation, there is indeed a significant negative correlation (-0.219) with the average investment along the whole period (*ki*). Regarding human capital accumulation, there is also a significant negative correlation (-0.465) with the total average years of schooling in 2005 (*schooling*). The correlation with innovation and institutional quality (*icrg_qog*) are also negative, -0.548 and -0.591 respectively. On the other hand, we expect our second component, the residual, to be positively correlated with capital accumulation. The correlation with physical capital accumulation is in fact positive (0.111), but it is non-significant when we consider human capital accumulation (as it is non-significant when we consider institutional quality). In any case, and in sum, our two components seem, indeed, two capture different dynamics, one negative and another one positive, of long-run economic growth.

Table 4 presents results for the impact of inequality on long-run growth from estimating equation (1). Column 1 shows the results from OLS estimation. From column 2 onwards each column presents the results from our 2SLS estimation where we introduce as a further variable in the growth equation the error term from the first stage - the estimation of inequality based on different sets of instruments according to the considered channels - in order to capture two differentiated components of inequality (see appendix for further details on this). We report the Hansen test probability to check for the validity of instruments.[11]

Table 4: OLS and 2SLS estimations

All controls have the expected sign in all estimations and their coefficients are all significant (except for that of mining). Results are consistent with conditional convergence, with a negative coefficient for initial per capita GDP around 2 per cent - as in Sala-i-Marti 2004 - and higher human capital levels increasing long-run growth (a positive coefficient for *life_exp* and *p60*). Openness and natural resource endowment (*mining*) are also positively associated with growth, while primary sector specialization is negatively so (a negative coefficient for *primary_exports*). For inequality, the OLS estimation yields a negative, although non-significant, coefficient. As Easterly highlights, OLS regressions are likely to underestimate the negative effect o inequality, and this could be due precisely to the coexistence of a parallel positive effect.[12] Regarding the 2SLS estimations, the coefficient for inequality is again always negative, but now becomes significant in some of the estimations, when we control for the two differentiated components - based on different set of instruments. In particular, the sets of instruments for domestic market and for fertility

[11] In fact, we test for the relevance and validity of our instruments in different ways. For relevance we look at the F statistic and R-square of the first regression. For validity we test perform over-identification tests: Basmann, Sargan (forcing non-robust standard errors) and Hansen (considering robust standard errors).

[12] We test for the endogeneity of inequality. Durbin and DWH tests suggest endogeneity and, therefore, the need of 2SLS (Wooldridge test, that considers robust standard errors, has a p-value of 0.12, still close to suggesting endogeneity).

yield significantly negative coefficients for inequality. The set of instruments for structural inequality also yields a significant and negative coefficient (column 6) for inequality as it does the set in which we include all the instruments for structural inequality plus all the other related to a negative effect of inequality, excluding those that do not pass the exogeneity test - *exp_edu* and *innovation* - (column 7). In all estimations but one, the coefficient for our residual, which captures the remaining variance in inequality not explained by the instruments considered, is always positive. Interestingly, the coefficient is significant only when we control for the fertility mechanism (column 5) or for all the instruments related to either structural inequality or to its negative effect on growth (column 7).

These results support previous results of a negative effect of inequality related to the socio-political instability approach, the arguments related to the domestic market size and the role of the middle class, and the fertility approach. Furthermore, our results support the idea of two differentiated and parallel effects of initial inequality, one negative and one positive. Nevertheless, these two parallel effects only become evident when we properly control for the differentiated mechanisms for inequality to have and influence on growth (something not done before). Regarding the total impact of inequality, we have to bear in mind that while our estimated negative inequality captures up to 80 per cent of the variance in inequality, the residual only captures the remaining 20 per cent. Thus, taking this into account we can approximate the negative effect to 0.030 while the positive to 0.018. Taking both of these together, the net and direct impact of inequality on long-run growth is still negative and close to 0.012 (a value close to that given by the OLS estimation). An effect that is economically significant if we take into account the wide differences in the Gini coefficients among countries (the difference between the country with the highest inequality in 1970, Honduras, and the country with lowest, Hungary, can represent half point of average annual growth).

Results by level of development

Is there always a positive effect of inequality on economic growth? According to Galor and Moav (2004), as we have seen, the relationship between inequality and growth changes with the process of development and is expected to be positive only in early stages, and non-significant in developed economies.[13] However, Galor and Moav's analysis focuses on the role of credit market imperfections. Yet, we have seen that there are other channels at work. Hence, we can still have a positive effect of inequality at early stages of development, as suggested by Galor and Moav, but also a negative effect, as suggested by other approaches. We perform structural stability tests to our sample differentiating countries based on whether

[13] Indeed, the previous studied correlations of our two components of inequality with capital accumulation become stronger if we consider separately developing aside from developed countries. While for the whole sample there was a non-significant correlation between our residual and human capital accumulation, for developing countries (non-OECD members in 1970) that correlation is positive (0.16). Likewise, there is a higher correlation (0.241) with physical capital accumulation for developing countries than for the whole sample (0.111).

they were OECD members in 1970 or not, as a way to proxy for the stage of development.[14] As the tests support the possibility of differentiated effects, in table 5 we let the impact of our two negative components of inequality to vary for countries that were OECD members in 1970 and for countries that were non-members.[15] All controls remain significant, except for that for mining, as before. Our two estimated components of inequality are now, as expected, only significant (one positively and the other negatively) for non-OECD countries.

Table 5: Results by level of development

V. Sensitivity and Robustness Checks

A first check to our results would be to use different sets of instruments for each of the channels. This is very difficult for most channels given data availability. However, as noticed before, we do have several variables that could be used to capture the idea of socio-political instability. We try those considered by Alesina et al. (political instability dataset) at the expense of loosing 4 observations due to data availability. We still find significant coefficients for our two components of inequality: negative for the estimated inequality and positive for the residual.

As a second check to our results, we analyze the possibility of direct effects on economic growth of some of our instrumental variables, effects not associated to inequality. In particular, in the estimations of table 4, the coefficient for inequality and for our residual are both significant and of considerably higher magnitude when we use fertility rates as instruments than when we use other instruments. This result suggests a relevant and considerable effect associated to fertility that could be cancelled out by an opposing (positive) effect of inequality in the OLS estimations. In fact, it has been emphasized that fertility rates can have a direct negative and significant effect on long-run growth (Barro 2000). The fertility approach, as we have seen, is associated to family decisions relevant for physical and human capital accumulation. In column 1 of table 6 we control for fertility rates directly in the growth equation. The coefficient for fertility is negative and significant, as expected, but even controlling for fertility we still find two differentiated significant effects of inequality on growth. (Barro finds a non-significant effect for inequality, after controlling for fertility, but he does not consider, as we do, further opposing effects of inequality that could be cancelling each other out).

As with fertility approach, we expand our estimation to consider the role of other transmission channels directly in the growth equation. For our first channel under consideration, we follow Alesina and Perotti

[14] In particular, we tested parameter heterogeneity for the coefficients for our two components of inequality base on the OECD-nonOECD dichotomy.

[15] Thus, we expect to control for some country heterogeneities. Additionally, we also control for heterocedasticity and autocorrelation by clustering residuals by continents.

and construct an index using the method of principal components analysis (PCA) to proxy for socio-political instability (a table with the variables used in the PCA and its results are annexed). For redistributive policies we introduce *kg702007*. For the role of the domestic market we introduce *logGDP1970*, to capture domestic market size, and *Q3*, to capture the role of the middle class. Finally, we also introduce fertility rates. Once we have control for all the different transmission channels that yield a negative effect of inequality on growth, our second component, the residual, remains positive and significant.

Table 6:

VI. CONCLUSION

In this paper we have revised the literature on the effects of initial levels of inequality on economic growth. Building on previous empirical evidence, we have analyzed the role of each of the different transmission channels proposed by the various theoretical approaches on how inequality influences growth. Moreover, taking into account the idea of two differentiated components of inequality (WDR 2006) and by considering different proxies expected to relate to different transmission channels, we have empirically captured, and distinguished in a single model, a negative and a positive effect of inequality on long-run growth. Our results suggests, in line with the literature, that high inequality has indeed a negative effect on long-run growth by increasing social unrest and political instability, by lowering aggregate demand, and given its relationship with higher fertility rates. However, our results also support the possibility of a long-run growth-enhancing component of inequality, and allow us to see the relevance of the previous mechanisms that need to be controlled for that positive effect of inequality to become empirically evident.

Results emphasize the complexity of the dynamics between income distribution and economic growth. This complexity exists everywhere but is more intense in developing countries, as our results suggest. In that line, it is not whether inequality is harmful or beneficial for growth but how dynamics take place in these countries. In order to assess the impact of inequality on economic growth in a given country, therefore, one should focus on analyzing what is driving inequality and especially on what it is associated to. When structural and associated to political instability and social unrest, rent-seeking and distortive policies, lower capacities for investments in human capital and a stagnant domestic market, inequality is most likely expected to significantly harm long-run economic performance, as previous literature suggest. Accordingly, improving income distribution is expected to foster long-run economic growth, especially in low-income countries where the levels of inequality are usually very high. However, some degree of inequality, as theoretically argued before in the literature and as empirically suggested in this work, can also be good. When driven by market forces and associated to hard work and growth-enhancing incentives,

like risk taking, innovation and capital investments, some degree of inequality can play a beneficial role for growth. The challenge for policy makers is to control structural inequality that reduces the country´s capacities for economic development, while at the same time keeping in place those positives incentives that are also necessary for growth. To ease that task, a broader and deeper understanding of the dynamics behind the relationship between inequality and economic development proves to be of still of high relevance for further research.

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Appendix:

In our econometric framework we follow Woolridge (2002, pp.118-119) test for endogeneity. We assume the following model:

$$y_1 = \boldsymbol{z_1}\boldsymbol{\delta_1} + \alpha_1 Gini + u_1 \quad \text{(A.1)}$$

Where y_1 is economic growth, $\boldsymbol{z_1}$is a vector of control variables, $\boldsymbol{\delta_1}$ is a vector of parameters, $Gini$ is the measurement of inequality, assumed to have a potentially endogenous component, and u_1 is the unobserved disturbance. The set of all exogenous variables is denoted by $\boldsymbol{z}$, and $\boldsymbol{z_1}$ is a strict subset of $\boldsymbol{z}$. The exogeneity assumption is:

$$E(\boldsymbol{z}'u_1) = 0 \quad \text{(A.2)}$$

Hausman (1978, 1983) pointed out that there is a regression-based form of the Hausman test that turns out to be asymptotically equivalent to the original form of the Hausman test. We first write the linear projection of $Gini$ on $\boldsymbol{z}$ in error form as:

$$Gini = \boldsymbol{z}\boldsymbol{\pi_1} + v_2 \quad \text{(A.3)}$$

And consequently:

$$E(\boldsymbol{z}'v_2) = 0 \quad \text{(A.4)}$$

Since u_1 is uncorrelated with $\boldsymbol{z}$ (see A.2) it turns out that $Gini$ is endogenous in (A.1) if and only if $E(u_1 v_2) \neq 0$. Thus we can test whether the *structural error*, u_1, is correlated with the *reduced form error*, v_2. We write the linear projection of u_1 onto v_2 in error form as:

$$u_1 = \rho_1 v_2 + e_1 \quad \text{(A.5)}$$

Since both u_1 and v_2 are orthogonal to $\boldsymbol{z}$: $E(\boldsymbol{z}'e_1) = 0$. Consequently $Gini$ is exogenous if and only if $\rho_1 = 0$. Plugging equation (A.5) into equation (A.1) gives the equation:

$$y_1 = \boldsymbol{z_1}\boldsymbol{\delta_1} + \alpha_1 Gini + \rho_1 v_2 + e_1 \quad \text{(A.6)}$$

Where, by construction, e_1 is uncorrelated with $\boldsymbol{z_1}$, $Gini$ and v_2, and therefore, a standard *t* test on the variable v_2 where $H_0: \rho_1 = 0$ can be developed. The problem is that we cannot observe v_2, but we can estimate $\hat{v}_2$ in an OLS regression of (A.3). A heterokedastic-robust *t* statistic can be used if heterokedasticity is suspected under H_0.

In our case we assume that the effect of inequality ($Gini$) on economic growth has different channels, being positive and negative. Nevertheless, only the negative channels can be captured with proper instruments ($\boldsymbol{z}$), while the positive channels (namely $\boldsymbol{w}$) cannot be observed trough healthy instruments. Consequently we can see the inequality index as:

$$Gini = \boldsymbol{z}\boldsymbol{\pi_1} + \boldsymbol{w}\boldsymbol{\pi_2} + \omega_2 \quad \text{(A.7)}$$

Thus, when we perform the linear projection of $Gini$ on $\boldsymbol{z}$ in error form as in (A.3), the *reduced form error*, v_2, will be: $v_2 = \boldsymbol{w}\boldsymbol{\pi_2} + \omega_2$. Then, the linear projection of u_1 onto v_2 in error form will be as:

$$u_1 = \rho_1(\boldsymbol{w}\boldsymbol{\pi_2} + \omega_2) + e_1 \quad \text{(A.8)}$$

And consequently the parameter ρ_1 in equation (A.6) will be an estimation of the positive influence of inequality on economic growth, as far as all negative channels have been captured by $\boldsymbol{z}$.

Appendix:

List of countries:

Country	isocode	Country	isocode	country	isocode
Australia	AUS	Honduras	HND	Norway	NOR
Bangladesh	BGD	Hong Kong	HKG	Pakistan	PAK
Belgium	BEL	Hungary	HUN	Panama	PAN
Bolivia	BOL	India	IND	Peru	PER
Brazil	BRA	Indonesia	IDN	Philippines	PHL
Canada	CAN	Ireland	IRL	Portugal	PRT
China	CHN	Italy	ITA	South Africa	ZAF
Colombia	COL	Jamaica	JAM	Spain	ESP
Costa Rica	CRI	Korea, Republic of	KOR	Sri Lanka	LKA
Cote d`Ivoire	CIV	Madagascar	MDG	Sweden	SWE
Denmark	DNK	Malawi	MWI	Tanzania	TZA
Ecuador	ECU	Malaysia	MYS	Thailand	THA
Egypt	EGY	Mexico	MEX	Tunisia	TUN
El Salvador	SLV	Morocco	MAR	Turkey	TUR
Finland	FIN	Nepal	NPL	United Kingdom	GBR
France	FRA	Netherlands	NLD	United States	USA
Greece	GRC	Nigeria	NGA	Zambia	ZMB

Variables used:

Main Variables	Description	Source
Growth model		
growth	Accumulated annual average per capita GDP growth rate	Constructed with data from PWT (Summers and Heston) using real GDP chain data (rgdpch)
inequality	Gini coefficient	Gruen and Klasen 2008
log_pcgdp	Per capita GDP (in log)	Constructed with data from PWT (Summers and Heston) using real GDP chain data (rgdpch)
life_exp	Life Expectancy at birth, total years. 1970	World Bank
p60	Primary enrollment rate. 1960	Sala-i-Marti et al. (2004). From Barro and Lee (1993)
yrsopen	Number of years the economy has been open between 1950 and 1994	Sala-i-Marti et al. (2004). From Sachs and Warner (1995)
primary_exports	Fraction of primary exports in total exports. 1970	Sala-i-Marti et al. (2004). From Sachs and Warner (1995)
mining	Fraction of GDP in mining. 1971	Sala-i-Marti et al. (2004). From Hall and Jones (1999)
Inequality Model		
assassp2	Number of political assassinations	Sala-i-Marti (2004). From Barro&Lee
death	Crude death rate per 1000 people. Average between 1960 and 1990	Constructred using 1960 (or earlier available value) to 199 World Bank
wardum	Dummy for countries that have been involved in a war any time between 1960 and 1990	Sala-i-Marti (2004). From Barro&Lee
kg702007	Share of government consumption to real GDP. Average between 1970 and 2007	PWT. (Summers and Heston)
exp_edu	Expenditure in education	World Bank
fi_sm	Access to sound money	
innovation		
Q3	Share of the third quintile in the income distrbution.	From WIDER dataset (cross section constructed taking da for each country in the closest available year to 1970)
logGDP1970		PWT. (Summers and Heston)
fertility	Fertility rate. 1970	World Bank
mortality	Infant mortality rate, per 1000 live births. 1970	World Bank*
wheat_sugar	Proportion of land suitable to wheat compared to land suitable to sugar (in logs)	From Easterly (2007)
troppop	Proportion of population living in tropical areas	From Easterly (2007)
mount	Proportion mountainous land.	From Collier (2009)
Others		
ki	Share of investment to real GDP. Average between 1970 and 2007	Summers and Heston
schooling2005	Mean years of schooling, age 15+, total. 2005	World Bank**
icrg_qog_1984	Quality of Government Index (1984)	International Country Risk Guide

Notes: ** Missing values for Hong Kong filled with those of China. ** Missing values for MDG and NGA filled using "IIASA/VID Projection".

Empirical Evidence on the channels and variables used

	Socio-Political Instability	Political Economy	CMI	Domestic Market	Fertility	Effect on growth or inv.
Persson & Tabellini (94)		x Welfare transfers				Non-significant
Alesina & Perotti (96)	x Number of assasinations Number of violent deaths Number of successful coups Number of unsuccessful coups Dummy for Democracy					Negative
Perotti (96)	x Number of assasinations Number of violent deaths Number of successful coups Number of unsuccessful coups Dummy for Democracy	x Marginal tax rate Welfare expenditures	x Loan-to-value payments			Negative; Non-sig.; Negative
Falkinger & Zweimmuller (97)				x Index of Product Diversity		Non-significant
Svensson (98)	x Quality of property rights					Negative
Knack & Keefer (2000)	x Quality of property rights			x Population Aggregate GDP Openness		Negative; Non-significant
Barro (2000)					x Fertility rates	Negative

Tables and Figures:

Table 1:

Table 1:

	Mean	Std. Dev.	Maximum	Minimum
Growth	2.222	1.515	-0.903	7.620
inequality	44.108	9.377	26.400	62.400
log_pcgdp	8.381	1.010	6.332	9.891
life_exp	60.206	10.586	40.365	74.649
p60	0.799	0.237	0.100	1.000
yrsopen	0.447	0.357	0.000	1.000
primary_exports	0.104	0.097	0.009	0.555
Mining	0.040	0.047	0.000	0.208

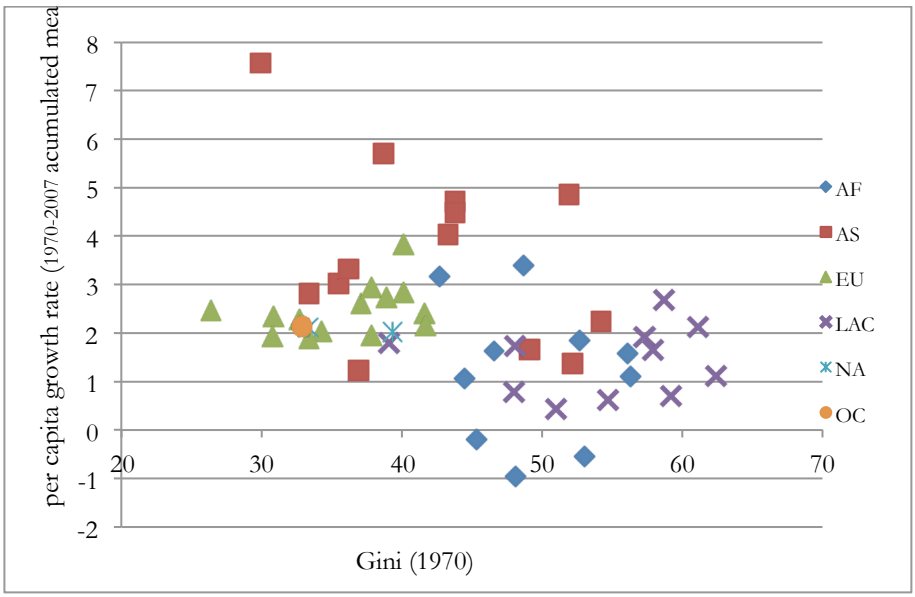
Included observations: 51

Table 2:

	growth	inequality	log_pcgdp	life_exp	p60	yrsopen	primary_exports	mining
growth	1.000							
inequality	**-0.371**	1.000						
log_pcgdp	-0.079	-0.301	1.000					
life_exp	0.302	-0.498	0.854	1.000				
p60	0.375	-0.321	0.703	0.837	1.000			
yrsopen	0.264	-0.337	0.696	0.707	0.629	1.000		
primary_exports	-0.345	0.239	-0.177	-0.264	-0.203	-0.120	1.000	
mining	-0.199	0.259	-0.253	-0.402	-0.254	-0.228	0.509	1.000

Included observations: 51

Figure 1:



Note: AF=Africa, AS=Asia, EU=Europe, LAC=Latin America and Caribbean, NA=North America, OC=Oceania (Australia).

Table 3:

Channel	Instrument						Firts Stage		First Stage - All	
		Mean	Std. Dev.	Min	Max	Corr with Inequality	Coeff.	Std. Err.	Coeff.	Std. Err.
Socio-Political Instability										
	assassp2	0.005	0.021	0.000	0.138	0.254	137.7486***	19.2211	108.9402***	20.7284
	death	12.102	4.365	5.678	23.500	0.173	0.3162	0.2424	-0.5521	0.3281
	wardum	0.392	0.493	0.000	1.000	0.265	5.2143**	2.5338	-0.2428	1.7723
							R-sq 0.175			
Political Economy										
	kg702007	8.593	4.264	2.221	20.918	0.020	0.1349	0.2933	-0.4704**	0.2167
	exp_edu	15.070	4.403	6.187	24.478	0.358	0.7780***	0.2467		
							R-sq 0.132			
CMI										
	fi_sm	7.017	1.608	2.518	9.647	-0.029	0.3087	0.7796		
	innovation	74.704	124.992	0.000	539.986	-0.492	-0.0376***	0.0072		
							R-sq 0.245			
Domestic Market										
	Q3	13.979	3.187	7.700	18.720	-0.792	-2.2332***	0.2682	-1.8709***	0.3739
	logGDP1970	10.470	0.780	8.740	12.573	-0.412	-0.8665	1.3342	-0.0555	1.8563
							R-sq 0.631			
Fertility										
	fertility	3.470	1.611	1.551	6.901	0.518	2.5742**	1.1507	2.0621*	1.0690
	mortality	76.620	51.507	11.200	193.000	0.460	0.0165	0.0369	-0.0193	0.0349
							R-sq 0.2710			
Structural Inequality										
	wheat_sugar	0.079	0.182	-0.393	0.442	-0.625	-28.3729***	4.2094	-6.1338	5.8535
	troppop	0.197	0.315	0.000	1.000	0.339	5.5921**	2.7382	-0.0302	2.4320
	mount	17.587	18.651	0.000	73.700	0.412	0.1130*	0.0586	0.0857	0.0584
							R-sq 0.502		0.794	

Notes: First stage estimations using robust standard errors and small sample correction. * p<0.10, **p<0.05, ***p<0.01

Tables 4:

First stage: Inequality Model		1	2	3	4	5	6	7
		SPI	**PE**	**CMI**	**DM**	**Fer**	**SI**	**All**
Instruments								
death		X						X
assassp1		X						X
wardum		X						X
kg702007			X					X
exp_edu			X					
fi_sm				X				
innovation				X				
Q3					X			X
logGDP1970					X			X
fertility						X		X
mortality						X		X
wheat_sugar							X	X
troppop							X	X
mount							X	X
Controls				X				
Second stage: Growth Model								
	OLS				**2SLS**			
Inequality	-0.0154	-0.0553	-0.0176	-0.0036	-0.0575**	-0.3001***	-0.0425*	-0.0381**
Std. Err.	(0.0144)	(0.0398)	(0.0368)	(0.0377)	(0.0263)	(0.0987)	(0.0234)	(0.0177)
Forcasted Resid		0.0443	0.0227	-0.0142	0.0817	0.2985***	0.0551	0.0907**
Std. Err.		(0.0404)	(0.0421)	(0.0360)	(0.0347)	(0.1008)	(0.0354)	(0.0349)
Controls	YES	YES	YES	YES	YES	YES	YES	YES
Observations	51	51	51	51	51	51	51	51
R squared	0.672	0.681	0.672	0.673	0.715	0.735	0.693	0.719
Hansen p-value		0.406	0.068	0.039	0.364	0.384	0.771	0.285

Notes: Estimations using robust standard errors.

Controls are: log_pcgdp, life_exp, p60, yrsopen, primary_exports and mining. *p<0.10, **p<0.05, ***p<0.01

Table 5:

Dependent variable: growth		
	Coef.	Std. Err.
c.INEQUALITY#c.OECD	-0.0305	0.0186
c.INEQUALITY#c.nonOECD	-0.0355***	0.0050
c.RESID_INE_negative#c.OECD	-0.0121	0.0283
c.RESID_INE_negative#c.nonOCDE	0.1079***	0.0242
log_pcgdp	-2.0920**	0.5852
life_exp	0.1188**	0.0332
p60	2.1056***	0.4539
yrsopen	1.3201**	0.4254
primary_exports	-4.6717**	1.1772
mining	4.3937	3.1936
cons	12.1376**	3.3563
Observations	51	
R squared	0.731	

Notes: Estimations using standard errors clustered by continent.
* p<0.10, **p<0.05, ***p<0.01

Table 6:

Dependent Variable: growth				
	1		2	
Inequality	-0.0189**	0.0062		
Forcasted Resid	0.0668***	0.0108	0.0543**	0.0152
fertility	-0.7808**	0.2712	-0.6809**	0.2077
spi			-0.1564	0.1302
kg702007			-0.0566***	0.0124
logGDP1970			0.3824	0.2382
Q3			0.0601**	0.0188
Controls	YES		YES	
Observations	51		51	
R sq	0.776		0.816	

Notes: OLS estimations using standard errors clustered by continent.
Controls are: log_pcgdp, life_exp, p60, yrsopen, primary_exports and mining.
*p<0.10, **p<0.05, ***p<0.01