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"Agglomeration, Inequality and Economic Growth"

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Abstract

The impact of income inequality on economic growth is dependent on several factors, including the time horizon considered, the initial level of income and its initial distribution. Yet, as growth and inequality are also uneven across space, it is also pertinent to consider the effects of the geographical agglomeration of economic activity. Moreover, it would also seem pertinent to consider not just the levels of inequality and agglomeration, but also the changes they undergo (i.e., their within-country evolution) and how these two processes interact with each other. By applying different econometric specifications and by introducing different measures of agglomeration at country level (specifically, urbanization and urban concentration rates), this study analyzes how inequality and agglomeration (both their levels and their evolution) influence economic growth in function of the country's level of development and its initial income distribution. Our results suggest, in line with previous studies, that while high inequality levels are a limiting factor for long-run growth, increasing inequality and increasing agglomeration have the potential to enhance growth in low-income countries where income distribution remains relatively equal, but can result in congestion diseconomies in high-income countries, especially if income distribution becomes particularly unequal.

JEL classification: O1, O4, R1
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1. Introduction

World trends over the last few decades point to two clear traits in economic growth: rising income inequality and increasing geographical agglomeration of economic activity within countries.1 This gives rise to various questions: Do these trends indicate that income inequality and agglomeration are necessary for growth? Is there an interaction between the two processes that is associated to growth? On the one hand, there is a considerable body of literature examining the relationship between inequality and economic growth and which adopts a range of theoretical and econometric approaches and methodologies. Some of these studies report a positive impact of inequality on growth; others find a negative effect. These mixed outcomes are usually explained by the fact that the impact of inequality on growth is channeled in different ways and is dependent on several factors, above all, the time horizon, the initial level of income (as a proxy for development) and its distribution. However, most of the literature fails to acknowledge the fact that growth and inequality are both uneven across space, and that the effects of inequality on growth are likely to differ with the geographical concentration of economic activity. On the other hand, there is another line in the literature that focuses on the relationship between the geographical agglomeration of economic activity and economic growth. The results here are also controversial pointing to different effects of agglomeration at the country level depending on the stage of development reached by that country. However, here, most of the literature fails to acknowledge the fact that these effects are likely to depend on socio-economic factors such as income distribution. Moreover, as dynamic processes, it seems relevant to consider not only the levels of inequality and agglomeration, but also the changes they undergo (i.e., their within-country evolution) and how these two processes interact with each other. In this paper, we set different specifications and introduce different measures of agglomeration at the country level (specifically, urbanization and urban concentration rates) to consider not only the effects of given levels of inequality and agglomeration, but also the impact of increasing inequality and agglomeration on economic growth. We analyze results based on different country characteristics, i.e., the level of development (measured by per capita income as in previous studies) and the level of income distribution.

This paper is organized as follows: first, the effects of income inequality on economic growth are reviewed (1.1). We then focus on the effects of urbanization (as a proxy for agglomeration) on economic growth (1.2) and review the interaction between urbanization and income inequality (1.3). We finish the section by examining the current policy debate (1.4). Section 2 describes the

[1] For an analysis of within-country inequality trends see the UNU-WIDER's research project *Rising Income Inequality and Poverty Reduction: Are They Compatible?* For an analysis of trends in agglomeration see the United Nations *World Population Prospects*.

empirical model followed (2.1) and analyzes the data (2.2). Section 3 presents the estimations and results of the effects of inequality and agglomeration levels on economic growth, while section 4 analyses the effects of changes in inequality and agglomeration. Finally, section 5 concludes.

1.1. The effects of income inequality on economic growth

The modern study of the relation between income inequality and economic growth dates back to Simon Kuznets, whose inverted-U hypothesis (1955) postulates that income inequality tends to increase first and then fall once a certain average income is attained. The implication is that economic growth in poor countries is likely to be associated with increasing inequality, at least in the short- and medium-term. However, in the second half of the twentieth century the economic performance of various countries seems to indicate that low initial levels of inequality result in higher and more sustained long-run growth.[2] High levels of inequality, when intense and persistent, seem to seriously limit economic growth. In fact, many developing countries today face low per capita income along with high inequality and disappointing growth performance. In most cases, very high levels of inequality are in all probability acting as a limiting factor for economic development.

Various theoretical channels have been identified via which income distribution might influence economic growth. Three channels have been proposed via which an unequal distribution of income can foster economic growth: 1) given a greater propensity to save among the rich, a moderate degree of income inequality allows, in a broad sense, for higher physical and human investment and, therefore, higher growth (Kaldor 1956); 2) under credit frictions and investment indivisibilities, higher inequality again increases investment (Aghion, Caroli and Peñalosa 1999); 3) finally, inequality generates incentives for capital accumulation and for innovation (Mirrlees 1971). By contrast, various channels can also be identified via which inequality acts as a limiting factor for growth: 1) higher inequality typically implies greater socio-political instability and a higher risk of violent conflict, which translates into uncertainty in property rights, reducing investment and growth (Alesina and Perroti 1996); 2) inequality generates redistributive pressure which may lead to economic distortions and disincentives that harm growth (Alesina and Rodrik 1994; Persson and Tebellini 1994); 3) in the presence of credit-market imperfections, higher inequality reduces the capacity of many individuals to invest and increases macroeconomic volatility (Aghion, Caroli and Peñalosa 1999), reducing average investment, especially in human

[2] In particular, the high growth performance of East Asian countries presenting relatively low levels of inequality has been compared to the weak performance of Latin American countries which have shown persistently high levels of inequality.

capital (Galor and Zeira 1993), and lowering long-run growth potential; 4) high inequality also implies a higher share of population with low purchasing power, which, given that the poor tend to demand local products, reduces aggregate demand (Todaro 1997); 5) finally, higher inequality is also related to higher fertility rates, which in turn reduces growth; in particular, as the number of children per family increases, the average investment in education falls (Barro 2000; Ehrhart 2009). Each of these channels will very possibly have a different explanatory power depending on the type of country and, more particularly, on its level of development and its initial income distribution.[3]

Turning to the empirical evidence, we can begin by distinguishing time horizon differentials. Note that the factors that support a positive relation between inequality and economic growth are more likely to act in the short run, while those supporting a negative relationship are more likely to act in the long run. Indeed, many studies have focused on the long-run effects of income inequality on economic growth based on cross-section analysis (Alesina and Rodrik 1994; Persson and Tabellini 1994; Clarke 1995; Perotti 1996; Temple 1999; and Easterly 2007).[4] Their results coincide in finding evidence that income inequality has a negative and significant effect on subsequent economic growth, independent of the measure used and robust to possible data quality problems. Interestingly, Alesina and Rodrik's results also indicate that countries that instigate land reforms, which significantly improve wealth - as well as income - distribution, grow faster. Easterly differentiates between *market inequality* and *structural inequality*. However, Easterly, using factor endowment differentials across countries - in particular, the exogenous suitability of land for wheat versus sugarcane, focuses empirically solely on long-run structural inequality. Since 1996, given greater data availability (thanks to Deininger and Squire 1996)[5]; various studies have analyzed the effects of inequality on growth using panel, instead of cross-country, data. Panel data sets can be more puzzling but also more enriching; their analysis facilitates the differentiation of short- and long-run effects and allows us to control for time-invariant omitted variables. Focusing on how the change in inequality within a given country is related to economic growth within that country we can measure short-run effects. Results in this line indicate that "in the short and medium term, an increase in a country's level of income inequality has a significant positive relationship with subsequent economic growth" (Forbes 2000), what would be linked with Easterly's market inequality.

[3] It has also been reported that the relative importance of each channel is likely to be associated to the *profile* of inequality. Inequality in different parts of the distribution is associated with different channels and, therefore, it has different implications for growth; top-end inequality fosters growth, while bottom-end inequality retards it (Voitchovsky 2005).
[4] Benabou (1996) reviews the literature in depth.
[5] Deininger and Squire have compiled a data set of inequality measures for 108 countries.

As mentioned, the impact of inequality on growth is also likely to vary between countries depending on their level of development (Partridge 1997; Barro 2000). Here, development is usually understood as the level of per capita GDP. Barro (2000) uses panel data and follows his "Determinants of Growth" model (1998) in which he introduces variables for inequality.[6] He examines the effects of inequality on growth through the impact of the former on the fertility rate. His results show a negative correlation between initial inequality and subsequent growth. The Gini coefficient is allowed to interact with the level of GDP (in log scale) to show that inequality is negatively correlated with growth in low-income countries - per capita GDP below $2070 (1985 US dollars) - but positively correlated with growth in high-income countries.

Finally, the effects of income inequality on growth are also likely to depend on the initial levels of inequality themselves. Chen (2003), using cross-section analysis, finds an inverted-U relationship between initial income distribution and long-run economic growth; the effect of inequality on growth is positive when initial inequality is low and negative when initial inequality is high. In fact, the level of inequality that maximizes growth corresponds to a Gini coefficient of 0.37, the average level for East Asia and West Europe in 1970. Chen's results suggest that growing rates of inequality are likely to have a different impact on growth depending on initial levels; for a country with low initial inequality, increasing inequality can foster economic growth, while for a country with high initial inequality, it can increase growth via the redistribution of income. In fact, some studies conclude that it is the changes in inequality, and not the levels of inequality, that we should be examining (Banerjee and Duflo 2003).

To sum up, the literature tends to suggest that income inequality is positively correlated with subsequent economic growth in the short run, but negatively so in the long run. In parallel, inequality levels seem to be more detrimental to low-income than they are to high-income countries. Additionally, increasing inequality is more likely to foster growth in countries with initially low inequality than in those with initially high inequality.

[6] The independent variables used are the initial level of p. c. GDP (in log scale), its square, the average ratio of government consumption to real GDP for the period, the average ratio of investment to real GDP for the period, the average rate of inflation for the period, the average fertility rate (in log scale) for the period, the average growth rate in terms of trade for the period, the initial level of year of schooling, the rule of law index, a democracy index and its square. His panel is composed of data for ten-year periods from 1965 to 1995.

1.2. The effects of urbanization on subsequent economic growth

Economic history tells us that urbanization, industrialization and economic development – via higher economic growth - tend to be parallel processes. Indeed, economic growth has tended to increase urbanization in almost all countries. Yet, the question remains as to if, and also when, the geographical agglomeration of economic activity (which is related to urbanization) fosters subsequent economic growth. This matter is a critical one and the focus of current research in urban economics and economic geography. In fact, the World Development Report of 2009 highlights that "the concentration of economic production as countries develop is manifest in urbanization ... but the question is whether concentration (and therefore urbanization) will increase prosperity" (WDR 2009). Theory and evidence point towards a positive effect of agglomeration on economic growth. "Due to localized spillovers, geographical agglomeration fosters growth" (Dupont 2007). Adopting various measures of urbanization, some studies empirically report a growth-enhancing effect on countries' income in the long run (Henderson 2003; Brülhart and Sbergami 2009).[7] However, the effect is likely to be complex and dependent on several factors. Firstly, the growth-enhancing effect of urbanization depends on the level of development. The geographical concentration of economic activity favors growth in early stages of development - thanks to economies of agglomeration - but hinders it in later stages – due, in the main, to diseconomies of congestion (Williamson 1965). Brülhart and Sbergami suggest a critical level of per capita GDP of US $10,000 (in 2006 prices) at which higher rates of urbanization become detrimental for growth. Secondly, the growth-enhancing effect of urbanization also depends on the way urbanization takes place (Bloom et al. 2008).[8] Finally, the degree of urban concentration may be more important than urbanization per se. The growth-enhancing effects of urbanization, related to scale and agglomeration economies, and particularly in developing countries, are significant for large urban agglomerations but not for small ones (Duranton and Puga 2004; Rosenthal and Strange 2004; Bertinelli and Strobl 2007).

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[7] As Brülhart and Sbergami note, different spatial scales imply that different mechanisms are at work, which may yield different results. At the small spatial scale, positive spillovers are associated with clustering activities (mainly knowledge spillovers) and agglomeration may have a positive impact on economic growth. The impact is probably even more marked in more developed countries. However, the results they present are concerned with a larger spatial scale, where the impact is related to a reduction in transaction costs and a greater integration of markets.

[8] When urbanization takes place as a result of the forced displacement of people from the rural areas - due to violence and social conflict, natural catastrophes and lack of opportunities, urbanization takes place in a non-planned way and is, therefore, more likely to delay economic growth. Bloom et al. (2008) compare industrialization-driven urbanization in Asia (considered as likely to enhance economic growth) with urbanization due to population pressure and conflict in Africa, which is more than likely to be detrimental for growth. In Latin America, the absence of proper urban planning is also evident in certain countries (Angotti, 1996).

Hence, given that both inequality and urbanization affect subsequent economic growth, what can be said about the relationship and interaction between the two?

1.3. The relationship between urbanization and income inequality

The same evidence that supports the idea that urbanization can promote economic growth, at least in the early stages of development, implies that there is a possible trade-off between economic growth and equal distribution of income, at least in spatial terms. As Brülhart and Sbergami argue, poor countries face a dilemma between lower inter-regional inequality and higher economic growth. In fact, the relationship between development and income inequality described by Kuznets is highly related to the processes of urbanization.[9] Classical dual economy models of structural change show that inequality is somehow an inevitable outcome of the process of urbanization that is characteristic of economic development (Lewis 1954; Harris and Todaro, 1976). These models seek to explain how inequality rises with urbanization before later falling back. Two reasons can be given to explain this inverted-U relationship between urbanization and inequality. On the one hand, the mean income differential between the agricultural sector and the urban sector, and the progressive migration from the former to the latter, is enough to generate the inverted-U relationship (Knight 1976; Fields 1979). On the other hand, the relationship can also be explained by income differentials within the urban sector. For Harris and Todaro, the constant influx of workers allows for excess supply in the urban sector resulting in unemployment. Rauch (1993) modifies Harris and Todaro´s model to introduce formal and informal employment (underemployment) in the urban sector. Given that wages are higher in formal employment, inequality rises when urbanization and rural wages are both low, creating incentives to migrate even at risk of underemployment in the urban sector. Inequality falls back as urbanization increases; the exodus from rural areas raises agricultural wages -reducing inter-sector income differentials- and reduces the willingness to migrate at risk of underemployment, thereby lowering underemployment itself -reducing intra-urban income differentials. Rauch's model, therefore, also helps to explain the "rise and fall of urban slums" characteristic of the developing world.

Models of the New Economic Geography similarly help explain how economic development is associated with increasing urbanization and inequality in its early stages. Agglomeration economies are the key element. Increasing returns of industrial activities, falling transport costs and labor mobility generate a concentration of workers and economic activity in the urban sector,

[9] M. Dimou (2008) reviews the literature on the relationships between urbanization, agglomeration effects and regional inequality.

allowing higher urban wages.[10] Economic growth is, thus, facilitated by structural change in the economy, which allows it to enjoy the benefits of increasing returns and agglomeration economies. This structural change is brought about by the process of urbanization, with people and resources being reallocated from agricultural activities towards industrial activities. The process leads to increasing inequality, as higher incomes are paid in urban areas compared to those paid in rural areas. Both higher inequality and greater urbanization favor the concentration of the production factors necessary for growth, and this concentration itself further strengthens the reallocation of labor from rural to urban areas (Ross 2000). In later stages of development, however, higher urbanization is associated with lower levels of inequality and agglomeration economies become exhausted as congestion diseconomies become significant. In parallel, the concentration of people in the cities raises rural salaries leading to a reduction in income differentials.

1.4. Policy debate

The WDR 2009 supports the argument of spatially unbalanced growth; indeed, economic growth is seldom balanced. Economic development is uneven across space and, as such, will lead to geographical disparities in income, especially in developing countries. Moreover, interventions to reduce spatial disparities can be highly inefficient in terms of national growth performance (WDR 2009). Therefore, given that inequality, urbanization and growth go hand in hand, the key element is the relation of forces between the three processes, at least as countries develop. Thus, rather than concluding that inequality is either good or bad for growth, it would seem to be the case that some degree of inequality is "natural" to the process of urbanization associated with growth.

However, a number of studies have recently concluded that economic growth does not need to depend on increasing urban concentration: "mega-urban regions are not the only possible growth pattern (...) context and institutions do matter when we consider economic geography" (Barca et al. 2011). In developing countries, "where institutions are insufficiently developed, it may well be the case that urban expansion is the only realistic option for overcoming institutional problems and promoting growth and development" (Barca et al. 2011). Moreover, increasing levels of urban concentration might not necessarily be associated with economic development. Interactions between economic geography and institutions are critical for development, as Barca et al. emphasize.[11] In fact, that the process of urbanization - and the increasing inequality associated

[10] Dixit and Stiglitz (1977) and Krugman (1991) account for agglomeration in terms of increasing returns and decreasing transport costs.
[11] The fundamental role of institutions for long-run growth has long been defended by many authors, such as Robinson et al. (2005) among others. Robinson et al. relate institutions, along with a series of others factors, to "some degree of equality of opportunity in society".

with it - can be modified by social and institutional factors has already been considered in the literature: the displacement of people and resources from rural to urban areas can be motivated by "pathological non-economic factors", such as war, ethnic conflict and bright lights, rather than by agglomeration economies and higher productivity (Kim 2008). Additionally, the process of urban concentration seems, sooner or later, to lead to congestion diseconomies, as noted above. In developed countries, where institutions are relatively good, economic growth can be based on a different urban system.[12] The OECD 2009 Report also highlights the idea that growth opportunities are both significant in large urban areas as well as in smaller more peripheral agglomerations.

By considering process of agglomeration and inequality, and their interaction, we can, therefore, differentiate development patterns based on the characteristic conditions presented by a country. Urban concentration is expected to enhance economic growth in developing countries, as suggested by the WDR 2009, and this process is also expected to be associated with increasing inequality, as suggested by the theoretical literature reviewed above. It is to be seen whether these processes are affected by a country's levels of income and inequality. In developed countries we expect the picture to be different, as suggested by Barca et al. (2011): alternative urban structures, apart from merely increasing urban concentration, may offer greater opportunities for growth.

2. Empirical Model and Data

2.1. Determinants of Growth

Sala-i-Martin (2004) using cross-section regressions, and Barro (1998, 2000, and 2003) using panel data, have conducted in-depth analyses of the determinants of economic growth. Sala-i-Martin et al. (2004) explore 67 possible explanatory variables for long-run growth between 1960 and 1996 and find 18 that are significantly related to it. These results show that cross-country differences in long-run growth in per capita GDP are well explained using initial levels of per capita GDP - the neoclassical idea of conditional convergence - and variables of natural resource endowments, physical and human capital accumulation, macroeconomic stability, and productive specialization (a negative and significant effect being found for the fraction of primary exports in total exports). Barro (2003) also supports conditional convergence "given initial levels of human capital and values for other variables that reflect policies, institutions, and national characteristics". In line with these studies and in order to analyze the impact of inequality and

[12] Barca et al. (2011) analyze the case of Europe where, they explain, economic growth is given in small to medium-size cities.

urbanization on subsequent economic growth, we develop an econometric model of growth that controls for conditional convergence, levels of human capital and investment. Other time-invariant country characteristics can be controlled for using panel data techniques. This approach is common in empirical studies of inequality and growth (Alesina and Rodrik 1994; Perotti 1996: Forbes 2000).[13] Along with measures of initial income inequality, we introduce measures of agglomeration to analyze their effects on economic growth and to examine (in section IV) how these two processes (based on an examination of changes rather than levels) interact with each other.

2.2. Data

As all the authors that have tackled this question note, inequality data are scarce. This scarcity, together with quality concerns, seems to have conditioned the analysis of the effects of inequality on economic growth. Inequality can be measured using various indicators (Gini coefficient, Theil index, quartile shares, etc). The main, and most complete, dataset of Gini coefficients is that provided by the World Income Inequality Database (WIID-WIDER). However, different sources of raw data can be used to construct the Gini index. Besides quality, there are three factors to take into account: 1) the object under measurement - which might be gross income, net income, expenditure or consumption; 2) the unit of measurement - individual, family or household; and, 3) the coverage of data - urban, rural or both. Knowles (2001) recommends using net income, expenditure or consumption, since the explanations of the effects of inequality on growth are concerned with income distribution once redistribution has taken place. Yet, in the case of developing countries, Gini coefficients based on expenditure or consumption are scarce. Therefore, data based on net (or disposable) income that measure household or family income levels and which provide total population coverage are preferred.

Given this variety of data, some authors adjust their data to try to solve the problem of significant differences, while others prefer to use unadjusted data. Clarke (1995) finds that the correlation between inequality and growth is not “fragile” despite data quality concerns. He uses unadjusted data, pre- and post-tax (choosing pre-tax data when available and household data if possible), for

[13] Alesina and Rodrik use cross-section data and include income and land (as a proxy for wealth) distribution variables along with control variables for initial level of income and primary school enrolment ratio, taking 1960-1985 and 1970-1985 time horizons. As control variables, Perotti includes the initial level of income, the initial average years of secondary schooling in the male and female population (MSE and FSE) and the initial PPP value of investment deflator relative to the U.S. Forbes also adopts Perotti’s specification but uses panel data. Other authors include additional control variables. Clarke’s cross-section study, for instance, includes the initial level of income, primary and secondary enrollment rates lagged ten years, the average number of revolutions and coups per year between 1970 and 1985, the deviation of the price level for investment in 1970 from the sample mean and the average government spending of GDP between 1970 and 1988. His time horizon is 1970 to 1988.

his cross-section analysis. To account for measurement errors, he uses a two-stage least-squares estimation instrumenting for the inequality variables and conducts a sensitivity analysis. Barro (2000) also uses unadjusted data, but uses dummies to control for differences in the methods measuring the Gini coefficients. However, more recent empirical studies (i.e. Gruen and Klasen 2008) express some concern about using unadjusted data. For the analysis undertaken here, given the complexity of the data problem and in line with recent concerns about the use of inequality data in the earlier literature, we follow Gruen and Klasen and use their coefficients.[14] These are taken from the WIID, adjusted to match the object under measurement, and measuring households or families in the entire population. These data have been previously used, for instance, by Atkinson and Brandolini (2010).

We use GROWTH as our dependent variable, which reflects the accumulated annual average per capita GDP growth rate. As independent variables, we use the initial level of per capita GDP in logs (LOG_PCGDP), the initial price of investment (PI), the initial level of years of schooling (SCHOOLING), the initial level of the Gini coefficient (INEQUALITY) and a measure for agglomeration. To measure agglomeration at country level we consider urbanization measures: the initial rate of urbanization (URB) and the initial rate of population in agglomerations of more than 1 million as a proportion of the total population (URB_1M), which captures urban concentration.[15] A table with all the variables used and their sources is included in annex 1.

Our sample includes 51 countries with data for the period 1970 to 2007. We take the data for 1970, 1980, 1990 and 2000 to explain the growth in each subsequent decade in the panel. The countries selected are those for which reliable data for all the variables used here have been found. A list of the countries considered is contained in annex 2. The sample, although relatively small, includes major countries from all the world's regions. Moreover, it is comparatively larger than samples used in most previous studies and provides sufficient information to meet our purposes.[16]

[14] The following missing values for Gruen's Gini coefficients have been filled based on trends and/or interpolations: Bolivia 1980 and 2000, Ecuador 1980, Egypt 1980, Honduras 1980, Korea 1980, Nepal 1990, Peru 1980 South Africa 1980, Tanzania 1980 and Zambia 1990.

[15] We experimented with other measures of agglomeration at country level. As well as urbanization and urban concentration measures, we considered the share of population concentrated in the largest city (PRIMACY). We also considered two variables employed in the related literature: the geographical concentration of population (GEO_CONC) and the average population per square km (DENSITY). We only present results for URB and URB_1M. These urbanization measures, besides being the most widely used, capture the agglomeration of population and economic activity and seem to relate more closely to the analysis conducted here, as our results show.

[16] The sample includes: 11 countries form Latin America & the Caribbean, 2 from North America, 10 from Africa, 13 from Asia, 1 from Oceania and 14 from Europe.

Table 1 shows the descriptive statistics for our main variables. The variance of each variable can be broken down into *between* variance, reflecting the variance between countries, and *within* variance, reflecting the variance over time within countries. The variance in the variables related to levels tends to be most obviously attributable to cross-sectional differences between countries. If we examine the variables related to changes, however, both the between (cross-section) and within (over time) variances are more balanced.

Table 2 shows the descriptive statistics by period for GROWTH, INEQUALITY and urbanization measures. INEQUALITY, URB and URB_1M, all present increasing trends over time.

Table 1: Descriptive statistics

		Std. Dev.				
	Mean	Overall	Between	Within	Maximum	Minimum
GROWTH	2.3020	2.1835	1.4753	1.6197	10.4990	-4.4309
LOG_PCGDP	3.7779	0.4709	0.4560	0.1299	4.6209	2.7500
SCHOOLING	6.2272	2.8526	2.5928	1.2306	13.0221	0.5000
PI	70.9360	40.1247	32.7336	23.5444	19.0652	315.6483
INEQUALITY	44.8642	9.5423	8.6704	4.1219	66.6000	23.5000
URB	51.7960	23.0178	22.3927	5.9829	100.0000	4.0000
URB_1M	20.3945	16.4260	16.3776	2.3565	100.0000	0.0000
*Δ*INEQUALITY	1.0098	6.1005	2.4285	5.6032	19.9000	-22.2000
*Δ*URB	4.3771	3.5829	2.7819	2.2803	17.1000	-4.6000
*Δ*URB_1M	1.3159	1.9985	1.4792	1.3546	10.8242	-6.6017

Included observations: 204 for variables in levels, 153 for variables in changes.

Table 2: Descriptive statistics categorized by period: growth, inequality and urbanization:

	GROWTH		INEQUALITY		URB		URB_1M	
PERIOD	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
1970-1980	2.8529	2.1039	44.1078	9.3767	44.9392	23.1845	18.2170	15.4573
1980-1990	1.5401	2.2013	43.5863	9.0657	49.9482	22.9439	19.9734	16.0837
1990-2000	1.8462	1.9251	44.6255	10.1899	54.2259	22.4594	21.2248	17.1051
2000-2007	2.9690	2.1937	47.1373	9.3895	58.0706	22.0244	22.1646	17.2142

Annex 3 presents the correlations between our variables, while annex 4 presents scatter plots of variance (overall, between and within) for INEQUALITY, URB, URB_1M and GROWTH. An initial inspection of the data reveals several interesting points. Focusing on the variables related to levels: based on raw data, inequality is negatively correlated with subsequent economic growth (-0.22), but this value decreases (-0.11) when we control for time and country effects (i.e. adjusted data). Both urbanization measures (URB and URB_1M) are highly and positively correlated with income, but do not appear to be significantly correlated with economic growth. Finally, based on unadjusted data, inequality is significantly and negatively correlated with income and urbanization. A closer examination of the scatter plots, however, reveals an inverted-U shape between urbanization and inequality, with inequality appearing to increase during early stages of urbanization and decreasing later (similar, that is, to the relationship described by Kuznets between income and inequality). A more in-depth analysis of the data reveals differences between countries on different continents. Latin American countries, for instance, present much higher levels of inequality than countries with similar levels of income and urbanization on other continents.

Focusing on the variables related to change: there is no significant correlation between growth and change in either of the two urbanization measures or change in inequality. Additionally, inequality does not seem to increase more in those countries in which rates of urbanization or urban concentration increase most. However, and taking into account the non-linearity in the scatter plots (see annex 4), we can distinguish between countries on the basis of income and inequality levels (i.e. high or low in comparison to median values for the period). Annex 5 presents these correlations by income and inequality levels. It is now evident that a positive change in INEQUALITY is positively correlated with subsequent GROWTH in low-income countries, especially (0.36) in low-income, low-inequality countries, such as China, South Korea (in the 70s and 80s) and Morocco (in the 2000s). As for the change in urban concentration (URB_1M), the correlation with subsequent GROWTH is positive for low inequality levels and again strongly positive (0.48) for low-income, low-inequality countries (again China, South Korea and Morocco, but also others such as Bangladesh and Tanzania in the 2000s). By contrast, the same correlation is significantly negative (-0.31) for high-income, high-inequality countries, among which we find Colombia, Peru and South Africa (developing countries, but with relatively high incomes). Most developed countries are classified as high-income, low-inequality countries. For these, increasing INEQUALITY or increasing URB_1M does not show a significant correlation with GROWTH.

This initial descriptive analysis of our data seems to support most of our expectations. High levels of inequality seem to be detrimental to subsequent economic growth. However, the effect of increasing inequality - its evolution rather than level, as well as that of increasing agglomeration, seem to interact with each other and to depend on the characteristic conditions of a country (in this case income levels and its distribution).

3. Estimation and Results

We use panel data based on four periods: 1970-1979, 1980-1989, 1990-1999 and 2000-2007.[17] Our starting point is an econometric growth model which controls for conditional convergence, levels of human capital and investment, and we introduce measures of inequality and agglomeration:

$$growth = c + \alpha_0(y_{i0}) + \alpha_1(a_{i0}) + \alpha_2(i_{i0}) + (\boldsymbol{X'}_{i0})\boldsymbol{B} + u_i \qquad (1)$$

where (y_{i0}) is initial per capita GDP, (a_{i0}) is agglomeration, (i_{i0}) is inequality and $(\boldsymbol{X})$ the control variables considered.

Three main econometric problems arise from estimating (1): 1) GROWTH is calculated in terms of per capita GDP, our income variable, but owing to reverse causality from income to ***X***, *A* or *I*, these regressors may be correlated with the error term. We use explanatory variables, measured at the beginning of the period, as an initial measure for avoiding reverse causality and reducing endogeneity concerns. 2) The second problem concerns the existence of unobserved time-invariant country characteristics in the error term, which can make OLS estimators inconsistent. Random Effects (RE) estimations allow us to control for unobserved country specific effects and to retain cross-sectional differences, which is essential in our analysis as the variance of our variables (inequality and agglomeration) is mainly cross-sectional. However, if the country effects are correlated with the regressors - which is highly likely - RE is inconsistent and Fixed Effects (FE) estimations should be used to address the problem. FE also controls for time-invariant country specific effects, but only considers within variation. 3) The last problem is the presence of initial income as a regressor in (1) making it a dynamic panel model. To see this, equation (1) can be rewritten as:

$$y_{i1} = c + \gamma_0(y_{i0}) + \alpha_1(a_{i0}) + \alpha_2(i_{i0}) + (\boldsymbol{X'}_{i0})\boldsymbol{B} + u_i \qquad (2)$$

FE estimations of models of this type suffer dynamic model bias when the number of periods is small, as they are here. Partridge (2005) argues that GMM could correct the bias, but at the cost of eliminating one observation (of four in his as in our case) by country. Moreover, he argues that the use of GMM does not modify the main results in most related studies. In this way, OLS regressions of accumulated growth rates over initial values of explanatory variables can be interpreted as measuring the long-run effects of these variables on subsequent economic growth,

[17] Other studies (Barro, 2000; Forbes, 2000) are based on ten-year periods. As they note, higher frequency inequality data are extremely scarce and, for periods smaller than ten years, the within country variation in income inequality is very low, while the variation in growth may be too large.

as they capture how persistent cross-sectional differences in inequality affect long-run growth rates. RE should yield similar results when most of the variation is cross-sectional - as is the case with Gini coefficients. On the other hand, FE estimators capture how time-series changes in inequality within a country affect changes in its growth rate over time. Given that the coefficients only reflect within-country time-series variation, they can be interpreted as short-run effects. However, concerns might still be present about dynamic panel bias. Consistent estimation can be carried out using Blundell and Bond "system" GMM estimators (1998). The Sys-GMM estimator is based on a system of two equations: one of first differences of the original model, instrumenting possibly endogenous regressors with lagged levels, and the original equation, instrumenting with lagged first differences. Thus, Sys-GMM estimates are expected to be more efficient than any other dynamic GMM estimators, especially when α is close to one and when the between sample variance is large compared to the within sample variance (as it is in our case).

In Table 3 we present the four different estimators of model 1: OLS, RE, FE and Sys-GMM. We use URB_1M as our agglomeration variable. In Table 4 we present the same estimations but using URB instead. In all the estimations, period dummies are used to control the individual time effects. OLS, RE and FE estimations are conducted using GLS with robust standard errors. Sys-GMM is conducted using two-step estimation and Windmaijer's (2005) finite sample robust error correction.

Table 3: OLS, RE, FE and Sys-GMM (using URB_1M):

Dependent Variable:	GROWTH (t-1,t)			GROWTH (t-1,t)			GROWTH (t-1,t)			LOG_PCGDP(t)		
	OLS			RE			FE			Sys-GMM		
Variable	Coeff.	Std. Err.		Coeff.	Std. Err.		Coeff.	Std. Err.		Coeff.	Std. Err.	
LOG_PCGDP(t-1)	-0.8579	0.273	**	-1.1055	0.293	***	-3.6836	1.260	**	0.8166	0.060	***
SCHOOLING(t-1)	0.2011	0.120		0.2886	0.074	***	0.0879	0.139		0.0351	0.033	
PI(t-1)	-0.0165	0.006	**	-0.0173	0.006	***	-0.0178	0.007	*	-0.0004	0.001	
INEQUALITY(t-1)	-0.0723	0.015	***	-0.0581	0.012	***	0.0091	0.021		-0.0178	0.007	***
URB_1M(t-1)	0.0284	0.010	**	0.0283	0.013	**	-0.0470	0.074		0.0054	0.002	**
CONSTANT	12.5660	2.122	***	13.6542	2.312	***	34.6390	11.554	**	2.3096	0.721	***
R-sqd	0.246			0.237			0.353					
Obs	204			204			204			204		
ar1 test p-value										0.000		
ar2 test p-value										0.936		
J stat p-value										0.282		

Period dummies in all estimations not shown. Robust standard errors clustered by continent. Variables lagged 2 and 3 periods are used as instruments for Sys-GMM estimation. Asterisks indicate significance: *** 1%, ** 5% and * 10%.

Table 4: OLS, RE, FE and Sys-GMM (using URB):

Dependent Variable:	GROWTH (t-1,t)			GROWTH (t-1,t)			GROWTH (t-1,t)			LOG_PCGDP(t)		
	OLS			RE			FE			Sys-GMM		
Variable	Coeff.	Std. Err.		Coeff.	Std. Err.		Coeff.	Std. Err.		Coeff.	Std. Err.	
LOG_PCGDP(t-1)	-0.9415	0.362	**	-1.3031	0.398	***	-3.6321	1.284	**	0.8628	0.082	***
SCHOOLING(t-1)	0.2089	0.115		0.2923	0.070	***	0.1157	0.215		0.0285	0.044	
PI(t-1)	-0.0172	0.006	**	-0.0180	0.006	***	-0.0178	0.008	*	-0.0002	0.001	
INEQUALITY(t-1)	-0.0652	0.017	**	-0.0510	0.013	***	0.0048	0.019		-0.0130	0.008	*
URB(t-1)	0.0169	0.015		0.0226	0.017		-0.0388	0.029		0.0001	0.004	
CONSTANT	12.7181	2.852	***	14.5240	2.818	***	35.1510	12.000	**	1.8300	0.895	**
R-sqd	0.222			0.211			0.355					
Obs	204			204			204			204		
ar1 test p-value										0.000		
ar2 test p-value										0.658		
J stat p-value										0.080		

Period dummies in all estimations not shown. Robust standard errors clustered by continent. Variables lagged 2 and 3 periods are used as instruments for Sys-GMM estimation. Asterisks indicate significance: *** 1%, ** 5% and * 10%.

All controls have the expected sign for all estimations. Results are consistent with conditional convergence; initial per capita GDP has a negative and significant coefficient for growth (OLS, RE and FE estimations) and a positive coefficient in the Sys-GMM estimation (where per capita GDP, rather than its growth rate, is the dependent variable). Higher human capital levels and a lower initial price of investment increase long-run growth. In the case of agglomeration and inequality measures, results differ between estimations. In OLS and RE, urban concentration (URB_1M) is positively significant - Table 4 - while urbanization (URB) is not - Table 5.[18] Inequality levels show, as reported in the literature, a negative and significant effect on subsequent long-run economic growth. By contrast, in FE estimation, both agglomeration and inequality are insignificant. But FE only takes into account the variation over time within countries. Thus, these results could suggest that the effects of inequality on subsequent economic growth differ in the short run compared to the long run (as in Forbes 2000). Finally, we focus on the Sys-GMM estimates, given the possible problems of the OLS, RE and FE results. The Sys-GMM results indicate a significant and positive effect of urban concentration (URB_1M in Table 4), suggesting that higher levels of urban concentration foster growth - in line with Berinelli and Strobl (2007). Inequality, on the other hand, is negative and significant on subsequent economic growth.

[18] Of the five variables considered for agglomeration (*URB, URB_1M, PRIMACY, DENSITY* and *GEO_CONC*), only URB_1M and DENSITY were significant in RE, OLS and Sys-GMM estimations. None was significant in FE estimation.

4. Change in Inequality and Agglomeration, and Growth

As noted in section 2, some authors claim that it is the *change* in inequality, not only the *level* of inequality, which matters (Chen 2003; Banerjee and Duflo 2003). In addition to considering the effects of levels of inequality and agglomeration, we could therefore also consider the effects of increases in these variables. Moreover, economic theory, as we have seen, suggests that the process of increasing agglomeration interacts with that of increasing inequality, and that both are likely to influence economic growth. We have developed different models to consider *changes* in inequality (a country's growth in inequality over the previous ten years) and *changes* in agglomeration (a country's growth in agglomeration, similarly, over the previous ten years), as well as interaction terms between both processes. We choose to focus on urbanization and urban concentration measures as they seem to provide the most interesting information.

Tables 5 and 6 report the results for seven different specifications (in Table 5 we use URB_1M as our measure of agglomeration, while in Table 6 we use URB). We start by adding the two variables reflecting increasing levels of inequality and of agglomeration - the variables of change - to our basic model: equation (2) (results in column 1). We then add an interaction term between the two variables (column 2). Specification 3 introduces the interaction term alone. According to Partridge (1997) and Barro (2000), it is important to distinguish as to whether we are dealing with a low- or high-income country. Specification 4 takes this into account (categorizing each country relative to the median value for each period). According to Chen (2003), the impact of increasing levels of inequality depends on the initial levels of this variable. Specification 5 distinguishes between initially equal and unequal countries (again using the period median). Specification 6 mixes both criteria; thus, it segregates the effects between four groups of countries depending on a country's initial conditions (i.e., whether its initial levels of inequality and income are low or high). Specification 7 considers both processes - increasing levels of inequality and of agglomeration - interacting with each other and for the different levels of inequality and income. All seven specifications are conducted using System-GMM with two-step estimation and Windmaijer's (2005) finite sample robust error correction.

Table 5: Estimations using *URB_1M* as measure of agglomeration

Dependent Variable: LOG_PCGDP(t)

	1			2			3			4			5			6			7		
Variable	Coeff.	s.e.		Coeff.	s.e.		Coeff.	s.e.		Coeff.	s.e.		Coeff.	s.e.		Coeff.	s.e.		Coeff.	s.e.	
LOG_PCGDP(t-1)	0.8238	0.054	***	0.8339	0.051	***	0.8308	0.053	***	0.8614	0.052	***	0.8474	0.049	***	0.9109	0.036	***	0.8118	0.046	***
SCHOOLING(t-1)	0.0500	0.019	**	0.0453	0.020	**	0.0497	0.026	*	0.0379	0.017	**	0.0421	0.022	*	0.0341	0.016	**	0.0525	0.023	**
PI(t-1)	-0.0014	0.001	**	-0.0014	0.000	***	-0.0011	0.000	**	-0.0017	0.001	**	-0.0010	0.000	**	-0.0015	0.001	***	-0.0010	0.000	**
INEQUALITY(t-1)	-0.0141	0.004	***	-0.0129	0.004	***	-0.0114	0.003	***	-0.0148	0.004	***	-0.0120	0.004	***	-0.0105	0.004	***	-0.0136	0.003	***
URB_1M(t-1)	0.0046	0.002	***	0.0044	0.001	***	0.0045	0.001	***	0.0052	0.002	**	0.0034	0.001	**	0.0028	0.002		0.0045	0.001	***
ΔINE	0.0030	0.003		0.0025	0.003																
ΔURB_1M	-0.0008	0.012		-0.0001	0.011																
ΔINE*ΔURB_1M				0.0001	0.002		0.0008	0.001													
ΔURB_1M*GDP_LOW										0.0284	0.015	*									
ΔURB_1M*GDP_HIGH										-0.0196	0.009	**									
ΔINE*GDP_LOW										0.0037	0.003										
ΔINE*GDP_HIGH										0.0013	0.005										
ΔURB_1M*GINI_LOW													0.0202	0.007	***						
ΔURB_1M*GINI_HIGH													-0.0201	0.012							
ΔINE*GINI_LOW													0.0006	0.004							
ΔINE*GINI_HIGH													0.0075	0.005							
ΔURB_1M*GDP_LOW*GINI_LOW																0.0519	0.019	***			
ΔURB_1M*GDP_HIGH*GINI_LOW																-0.0020	0.011				
ΔURB_1M*GDP_LOW*GINI_HIGH																0.0040	0.029				
ΔURB_1M*GDP_HIGH*GINI_HIGH																-0.0389	0.019	**			
ΔINE*GDP_LOW*GINI_LOW																0.0046	0.007				
ΔINE*GDP_HIGH*GINI_LOW																-0.0019	0.005				
ΔINE*GDP_LOW*GINI_HIGH																0.0004	0.007				
ΔINE*GDP_HIGH*GINI_HIGH																0.0063	0.004				
ΔINE*ΔURB_1M*GDP_LOW*GINI_LOW																			0.0104	0.002	***
ΔINE*ΔURB_1M*GDP_HIGH*GINI_LOW																			-0.0024	0.002	
ΔINE*ΔURB_1M*GDP_LOW*GINI_HIGH																			0.0016	0.002	
ΔINE*ΔURB_1M*GDP_HIGH*GINI_HIGH																			-0.0005	0.002	
CONSTANT	2.0444	0.518	***	1.9354	0.475	***	1.8366	0.397	***	1.8217	0.506	***	1.7893	0.441	***	1.2472	0.388	***	2.0797	0.398	***
Obs	153			153			153			153			153			153			153		
ar1 p-value	0.108			0.099			0.070			0.039			0.082			0.110			0.045		
J stat p-value	0.176			0.258			0.192			0.199			0.199			0.245			0.162		

Estimation by System GMM using variables lagged 2 and 3 periods as instruments. Second order autocorrelation test (ar2) cannot be computed with only 3 periods, as is our case. Period dummies in all estimations not shown. Robust standard errors clustered by continent. Δ represents change between t-2 and t-1. Asterisks indicate significance: *** 1%, ** 5% and * 10%.

Table 6: Estimations using *URB* as measure for agglomeration

Dependent Variable: LOG_PCGDP(t)

	1			2			3			4			5			6			7		
Variable	Coeff.	s.e.		Coeff.	s.e.		Coeff.	s.e.		Coeff.	s.e.		Coeff.	s.e.		Coeff.	s.e.		Coeff.	s.e.	
LOG_PCGDP(t-1)	0.8548	0.086	***	0.8510	0.072	***	0.8784	0.070	***	0.8857	0.093	***	0.8668	0.067	***	0.9136	0.063	***	0.8190	0.079	***
SCHOOLING(t-1)	0.0635	0.031	**	0.0653	0.031	**	0.0468	0.030		0.0537	0.032		0.0610	0.024	**	0.0473	0.017	***	0.0549	0.036	
PI(t-1)	-0.0012	0.001	*	-0.0013	0.001	**	-0.0014	0.001		-0.0013	0.001	*	-0.0012	0.001	**	-0.0012	0.001	*	-0.0018	0.001	**
INEQUALITY(t-1)	-0.0143	0.004	***	-0.0142	0.004	***	-0.0102	0.003	***	-0.0145	0.005	***	-0.0102	0.005	**	-0.0080	0.005	*	-0.0141	0.004	***
URB(t-1)	-0.0014	0.005		-0.0011	0.005		-0.0004	0.004		-0.0028	0.005		-0.0016	0.004		-0.0012	0.004		0.0004	0.004	
ΔINE	0.0035	0.002		0.0042	0.003																
ΔURB	0.0128	0.007	*	0.0129	0.007	*															
ΔINE*ΔURB				-0.0003	0.001		0.0005	0.001													
ΔURB*GDP_LOW										0.0085	0.012										
ΔURB*GDP_HIGH										0.0106	0.009										
ΔINE*GDP_LOW										0.0047	0.003										
ΔINE*GDP_HIGH										0.0027	0.004										
ΔURB*GINI_LOW													0.0203	0.005	***						
ΔURB*GINI_HIGH													0.0048	0.008							
ΔINE*GINI_LOW													0.0040	0.004							
ΔINE*GINI_HIGH													0.0029	0.006							
ΔURB*GDP_LOW*GINI_LOW																0.0382	0.007	***			
ΔURB*GDP_HIGH*GINI_LOW																0.0073	0.004	*			
ΔURB*GDP_LOW*GINI_HIGH																-0.0027	0.011				
ΔURB*GDP_HIGH*GINI_HIGH																0.0064	0.010				
ΔINE*GDP_LOW*GINI_LOW																0.0073	0.004	*			
ΔINE*GDP_HIGH*GINI_LOW																-0.0035	0.005				
ΔINE*GDP_LOW*GINI_HIGH																0.0008	0.006				
ΔINE*GDP_HIGH*GINI_HIGH																0.0079	0.008				
ΔINE*ΔURB*GDP_LOW*GINI_LOW																			0.0039	0.001	***
ΔINE*ΔURB*GDP_HIGH*GINI_LOW																			-0.0004	0.002	
ΔINE*ΔURB*GDP_LOW*GINI_HIGH																			-0.0012	0.001	
ΔINE*ΔURB*GDP_HIGH*GINI_HIGH																			0.0015	0.001	
CONSTANT	1.7822	0.709	**	1.7858	0.603	***	1.5096	0.526	***	1.6845	0.784	**	1.5354	0.609	**	1.0841	0.596	*	2.1616	0.646	***
Obs	153			153			153			153			153			153			153		
ar1 p-value	0.077			0.071			0.097			0.106			0.096			0.259			0.227		
J stat p-value	0.214			0.319			0.0539			0.0890			0.395			0.414			0.0262		

Estimation by System GMM using variables lagged 2 and 3 periods as instruments. Second order autocorrelation test (ar2) cannot be computed with only 3 periods, as is our case. Period dummies in all estimations not shown. Robust standard errors clustered by continent. Δ represents change between t-2 and t-1. Asterisks indicate significance: *** 1%, ** 5% and * 10%.

Our results when using urban concentration (Table 6) show: 1) growth in agglomeration - measured as the within country change in URB_1M - seems to have a significant effect, but it varies with the level of development. Thus, there is a positive effect in early stages of development (low income), but becoming negative thereafter (specification 4). In fact, the significance of the positive effect disappears not only when income levels are high, but when inequality levels are high (specification 5). Moreover, it is only when both these levels are low that increasing urban concentration is good for growth. If income and inequality are both high, the coefficient becomes significantly negative; *congestion diseconomies* become relevant in high-income, high-inequality countries (specification 6). 2) In the case of increasing inequality, the coefficient for the change in inequality over time is insignificant in all specifications. However, specification 7 suggests that increasing inequality can be good for growth when combined with increasing agglomeration, again as long as countries do not already have high levels of income and inequality.

If instead of using urban concentration as our measure of agglomeration, we use urbanization (Table 7), we obtain slightly different results. In this case, although higher initial levels of urbanization do not seem to affect growth (as was the case of the results in Table 5), the coefficient for increasing urbanization (the within country change in URB) is positive and significant (specification 1 and 2). As such, increasing urbanization seems to be good for growth. However, again, this positive effect is no longer significant when inequality is high (specifications 5, 6 and 7). As for increasing inequality, this variable seems to have a significant and positive effect on growth, but again only in low-income, low-inequality countries (specification 6 and 7).

A comparison of the results in Tables 6 and 7 seems to tell us that high urban concentration levels are positively related to subsequent economic growth, while the correlation with urbanization levels is not significant. However, it might be the case that for small to medium-sized cities (where higher rates of urbanization do not necessarily imply greater urban concentration at country levels), the process of increasing agglomeration, as opposed to its level, is indeed positively related to growth. This occurs, in particular, if inequality levels remain relatively low. A further difference between the results obtained with URB and those obtained with URB_1M is that increasing urbanization (URB) seems to be positive and significant for the full sample of countries, while increasing urban concentration seems to be positive and significant only for low-income countries and can degenerate into congestion diseconomies in high-income countries.

Our results seem to support the WDR 2009 view that urban concentration is accompanied by growth. Yet, they also seem to support ideas contained in the OECD 2009 Report, to the effect that urban concentration might be the only realistic option for growth in developing countries, since the latter lack the proper institutional environment. In fact, there is a risk of congestion diseconomies resulting from increasing urban concentration when inequality is high i.e., in what we interpret as a weak institutional environment.[19] For developed countries, most of which are endowed with low levels of inequality and strong institutional environments, there might be higher growth opportunities in a more diverse urban system - which does not rely solely on increasing urban concentration. Thus, inequality levels do indeed seem to be a determining factor. Increasing urbanization (in both low- and high-income countries) and of urban concentration (in low-income countries) will have a positive effect in low-inequality countries, most probably endowed with good institutions. As regards the policy debate concerning the benefits of varying degrees of urban concentration, it seems clear, therefore, that the stage of development the country is at (here, reflected in levels of income and levels of inequality) is fundamental for any analysis.

5. Summary and Conclusions

This paper has studied the effects of income inequality and agglomeration at country level on economic growth. In doing so, we have taken into account not only the levels of the variables but also their evolution within countries over time, and the interaction between both processes. In the case of the levels of the variables, our empirical results seem to show, in line with the previous literature, that high inequality levels limit growth in the long run. Yet, and also in line with the literature, urban concentration tends to foster growth. Here, the possibilities for higher growth can be associated with the potential growth-enhancing agglomerations that countries acquire as economic activity concentrates at the urban level. In the case of the processes of increasing inequality and agglomeration (i.e., the variables of change as opposed to those associated with levels), initial conditions seem fundamental, whether the country is relatively poor or rich or whether income levels are relatively equal or unequal. Thus, interactions between economic geography and inequality (interpreted as part of the institutional environment) are indeed relevant. On the one hand, increasing agglomeration - be it increasing urbanization or increasing urban concentration - fosters growth in low-income countries; on the other hand, increasing urbanization, as opposed to increasing urban concentration, seems beneficial for high-income

[19] In fact, our Gini coefficient is strongly correlated with institutional quality measures. We consider IQI, the Institutional Quality Index (Krause 2007) and IQG, the ICGR indicator of Quality of Government (PRS Group). In both cases the higher the value of the index, the better the institutional quality. Considering our sample of 51 countries, the correlation between Gini in 1970 and IQG in 1984 (the earliest available values for these variables for our sample) is -0.52. This correlation rises to -0.64 (both values considered in 2000). Taking the IQI in 2007 (the latest value), the correlation with Gini in 2000 is -0.50.

countries. The key outcome is that in both high- and low-income countries, the positive effects of increasing agglomeration are felt in low-inequality countries. When inequality reaches a certain threshold, the benefits disappear and increasing urban concentration can degenerate into congestion diseconomies in high-income countries.

The policy implications of these findings vary according to the level of development. In the case of low-income countries, it has been argued that they should pursue growth first and then, when growth is secured, tackle problems of distribution - the frequently argued trade-off between efficiency and equity. This acknowledges the empirical fact that growth is by nature, and at least in the short-run, uneven. This unevenness is, quite crucially, also spatial, associated with the geographical concentration of economic activity (WDR 2009). Yet, it also seems quite clear that sooner or later, inequality becomes a handicap to growth. Indeed, developing countries that face high income inequalities also face greater obstacles to achieving sustained long-run economic growth. Both facts taken together mean that while achieving higher economic growth may imply greater inequality due to a greater geographical concentration of economic activity in the short run, it might also mean efforts for better income distribution in the long run as a way of reinforcing, as opposed to confronting, economic growth. For high-income countries, congestion diseconomies would seem to be a relevant issue that has to be addressed. A more balanced urban system, in which small and medium-sized cities play a fundamental role in the mobilization of local assets to exploit local synergies, seems to be a better strategy than intense urban concentration (OECD 2009). Finally, the fact that the benefits to be derived from agglomeration seem to depend on income distribution appears to point to the relevance of good institutions in the process of development, particularly in relation to economic geography. Clearly, the subject deserves further analysis and research.

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ANNEX

Annex 1: Variables used:

Variable	Description	Source
GROWTH	Accumulated annual average per capita GDP growth rate	Constructed with data from Summers and Heston, using real GDP chain data (rgdpch)
LOG_PCGDP	Per capita GDP (in log)	Constructed with data from Summers and Heston, using real GDP chain data (rgdpch)
PI	Price of investment	Summers and Heston
SCHOOLING	Mean years of schooling, age 15+, total	World Bank*
INEQUALITY	Gini coefficient	Gruen and Klasen 2008**
URB_1M	Population in agglomerations of more than one million as percentage of urban population.	
URB	Urban population as percentage of total population	
PRIMACY	Population in largest city as percentage of urban population	
GEO_CONC	Geographical concentration of population	
DENSITY	Average population by square km of land.	

* Missing values for MDG and NGA filled using "IIASA/VID Projection". ** Missing values filled based on trends: BOL 1980 and 2000, ECU 1980, EGY 1980, HND 1980, KOR 1980, NPL 1990, PER 1980 ZAF 1980, TZA 1980 and ZMB 1990.

Annex 2: List of countries:

Country	Country	Country
Australia	Honduras	Norway
Bangladesh	Hong Kong	Pakistan
Belgium	Hungary	Panama
Bolivia	India	Peru
Brazil	Indonesia	Philippines
Canada	Ireland	Portugal
China	Italy	South Africa
Colombia	Jamaica	Spain
Costa Rica	Korea, Republic of	Sri Lanka
Cote d`Ivoire	Madagascar	Sweden
Denmark	Malawi	Tanzania
Ecuador	Malaysia	Thailand
Egypt	Mexico	Tunisia
El Salvador	Morocco	Turkey
Finland	Nepal	United Kingdom
France	Netherlands	United States
Greece	Nigeria	Zambia

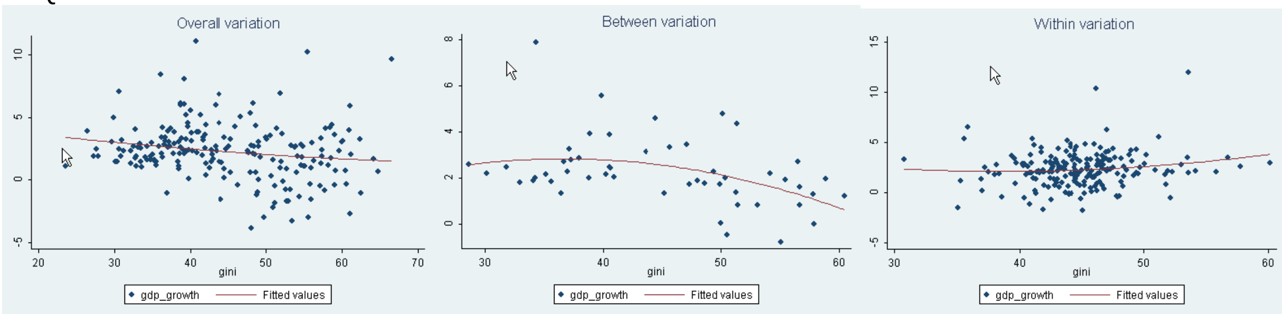
Annex 3: Correlations:

	GROWTH		LOG_PCGDP		INEQUALITY		URB		URB_1M		SCHOOLING		PI		ΔINEQUALITY		ΔURB	
	raw data	adj. data	raw data	adj. data	raw data	adj. data	raw data	adj. data	raw data	adj. data	raw data	adj. data	raw data	adj. data	raw data	adj. data	raw data	adj. data
GROWTH	1.000	1.000																
LOG_PCGDP	0.026	-0.588	1.000	1.000														
INEQUALITY	-0.219	-0.109	-0.443	0.068	1.000	1.000												
URB	-0.007	-0.085	0.863	0.141	-0.280	-0.135	1.000	1.000										
URB_1M	0.063	-0.012	0.486	0.077	-0.146	-0.032	0.625	0.558	1.000	1.000								
SCHOOLING	0.170	0.042	0.800	-0.043	-0.312	-0.325	0.741	0.264	0.421	0.228	1.000	1.000						
PI	-0.165	-0.037	0.143	0.080	-0.101	-0.110	0.235	0.087	0.083	0.070	0.134	-0.052	1.000	1.000				
ΔINEQUALITY	0.026	-0.123	0.004	0.134	0.336	0.748	-0.015	-0.046	0.023	-0.015	0.112	0.046	-0.053	0.006	1.000	1.000		
ΔURB	-0.031	-0.068	-0.174	0.158	0.209	0.008	-0.048	0.431	0.054	0.135	-0.223	0.047	-0.170	-0.019	-0.107	0.041	1.000	1.000
ΔURB_1M	0.001	0.050	-0.131	0.021	0.213	0.046	-0.025	-0.147	0.332	0.091	-0.172	-0.059	-0.090	0.061	-0.029	0.086	0.541	0.365

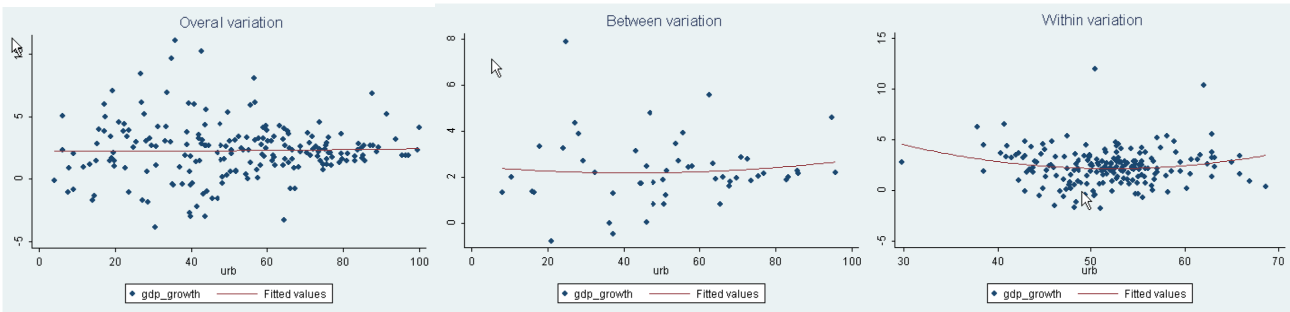
Adjusted data are obtained by eliminating time and country effects. Observations included: 153 (51 countries x 3 periods)
GROWTH is measured between t-1 and t. Other variables in levels are measured at t-1. *Δ* represents change between t-2 and t-1.

Annex 4: Scatter plots among key variables

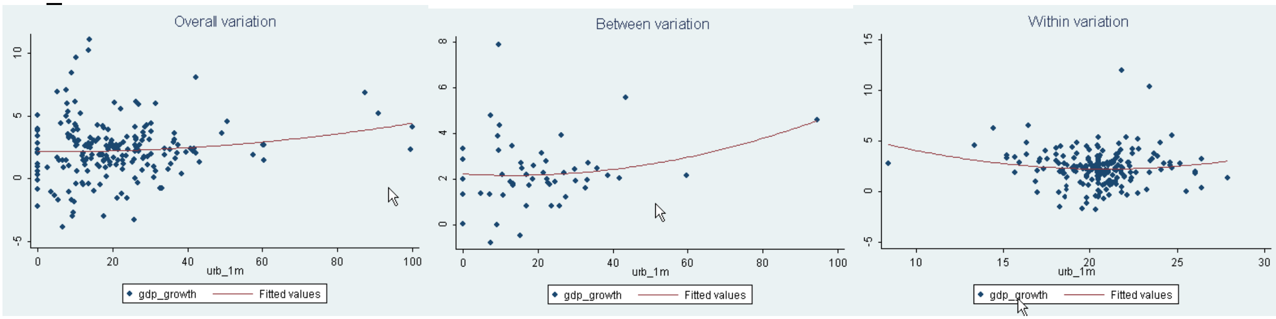
INEQUALITY vs GROWTH:



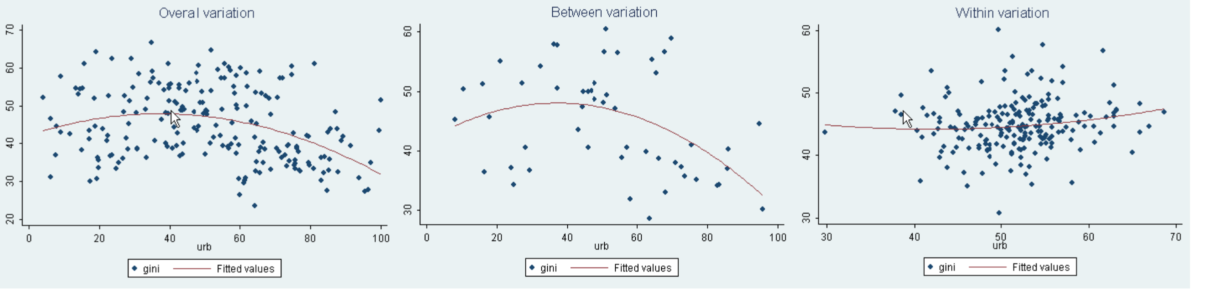
URB vs GROWTH:



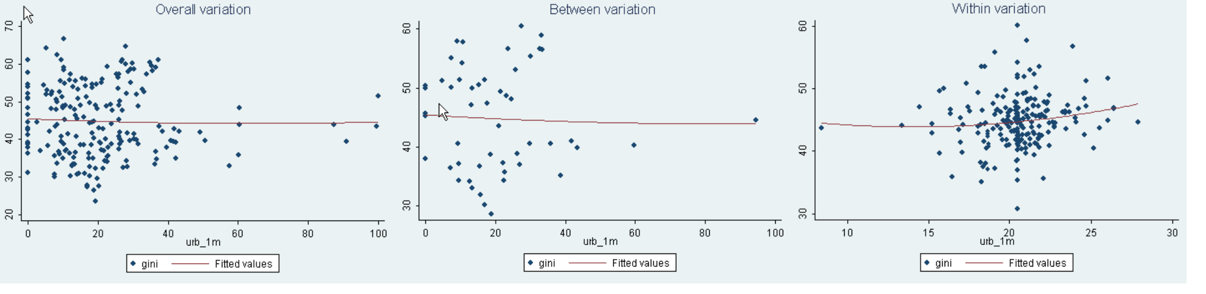
URB_1M vs GROWTH:



URB vs INEQUALITY:



URB_1M vs INEQUALITY:



Annex 5: Correlations by country´s characteristics:

For low-income-low-inequality countries: 24 observations

	GROWTH	ΔINEQUALITY	ΔURB	ΔURB_1M
GROWTH	1.000			
ΔINEQUALITY	0.356	1.000		
ΔURB	0.371	0.256	1.000	
ΔURB_1M	0.481	0.238	0.701	1.000

For high-income-low-inequality countries: 51 observations

	GROWTH	ΔINEQUALITY	ΔURB	ΔURB_1M
GROWTH	1.000			
ΔINEQUALITY	-0.136	1.000		
ΔURB	0.096	-0.170	1.000	
ΔURB_1M	0.130	-0.096	0.401	1.000

For low-income-high-inequality countries: 51 observations

	GROWTH	ΔINEQUALITY	ΔURB	ΔURB_1M
GROWTH	1.000			
ΔINEQUALITY	0.129	1.000		
ΔURB	-0.188	-0.288	1.000	
ΔURB_1M	-0.155	-0.211	0.543	1.000

For high-income-high-inequality countries: 27 observations

	GROWTH	ΔINEQUALITY	ΔURB	ΔURB_1M
GROWTH	1.000			
ΔINEQUALITY	0.199	1.000		
ΔURB	0.024	-0.552	1.000	
ΔURB_1M	-0.306	-0.252	0.414	1.000

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