Agglomeration, Inequality and Economic Growth: Cross-section and panel data analysis

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Abstract

The effects of income inequality on economic growth depend on several factors. On one hand, they depend on the time horizon considered, on the initial level of income and on its initial distribution. But, on the other hand, as growth and inequality are also uneven across space, it also seems relevant to wonder about the effects of the geographic agglomeration of economic activity. Moreover, it seems relevant to consider not only the *levels* of inequality and agglomeration, but also their *change* -their evolution within countries- and the interaction between both processes. By considering different econometric specifications and introducing different measures for agglomeration at country level, especially urbanization and urban concentration rates, this work analyzes how inequality and agglomeration -both their levels and their changes- influence economic growth depending on the level of development and on the initial distribution of income. Our results suggest that while high inequality levels are a limiting factor for long-run growth -consistent with previous literature-, increasing inequality and increasing agglomeration have the potential to enhance growth in low-income countries where income distribution remains relatively equal, but can degenerate in congestion diseconomies in high-income ones, especially if income distribution becomes too unequal.

Keywords:

Agglomeration, urbanization, urban concentration, congestion diseconomies, inequality, growth

JEL classification: O1, O4, R1

I. INTRODUCTION

Current world trends during past decades show two clear characteristics of economic growth: rising income inequality and increasing geographical agglomeration of economic activity within countries[1]. Several questions arise: Do these trends suggest that income inequality and agglomeration are necessary for growth? Is there an interaction between both processes that is associated to growth? On one hand, there is a long literature on the relationship between inequality and economic growth. Many authors have analyzed the effects of inequality on growth using different theoretical and econometric approaches and methodologies. Some works have found a positive effect of inequality on growth while others a negative one. These mix results have been interpreted as the effects of inequality on growth going through different channels and depending on several factors; in particular the time horizon, the initial level of income (as a proxy for development) and its distribution. However, most related literature has missed to acknowledge the fact that growth and inequality are uneven across space and that the effects of inequality on growth are likely to differ depending of the geographic concentration of economic activity. On the other hand, there is also another brand of the literature that focuses on the relationship between the geographic agglomeration of economic activity and economic growth. The results here are also controversial and also tend to indicate different effects of agglomeration at country level depending on country´s level of development. However, in this case, most of the literature has missed to acknowledge the fact that these effects are also likely to depend on socio-economic factors as income distribution. Moreover, as dynamic processes, it seems relevant to consider not only the *levels* of inequality and agglomeration, but also their *change* -their evolution within countries- and how these two processes interact with each other. In this work, we set different specifications and introduce different measures for agglomeration at country level, especially urbanization and urban concentration rates, to consider not only the effects levels of inequality and agglomeration, but also the effects of increasing inequality and agglomeration on economic growth. We analyze results based on different country´s characteristics: its level of development (measured by per capita income as has been done in previous works) and its level of income distribution.

This paper is organized as follows: the rest of this section reviews some of the main empirical works. In first place, the effects of inequality on economic growth are reviewed (section I.1). In second place we focus on the effects of urbanization (as proxy for agglomeration) on economic growth (section I.2). Finally, we review the interaction between urbanization and income inequality (section I.3). Section II sets the empirical model to follow (II.1) and analyzes the data (II.2), section III presents the estimations and results for the effects of inequality and agglomeration levels on economic growth, while section IV analyses the effects of *changes* of inequality and agglomeration. Finally, section V concludes.

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

I.1. The effects of income inequality on economic growth:

The modern economic study of the relation between income inequality and economic growth dates back to Simon Kuznets, who in 1955 showed that income inequality tends to increase first and then decrease with the level of income. This famous economic phenomenon has been called the "Kuznets inverted-U hypothesis". It implies that economic growth in poor countries is likely to come with increasing inequality, at least in the short and medium term. However, in the second half of the XXth century the economic performance of different countries seems to show that low initial levels of inequality enhance higher and sustained long-run growth.[2] High inequality, when intense and persistent, can become a serious limit for 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 very likely playing a limiting factor for economic development.

There are different theoretical channels through which income distribution may influence economic growth. On one side we can highlight three channels supporting that an unequal distribution of income fosters economic growth: 1) Given higher propensity to save by the rich, a moderate degree of income inequality allows for higher investment -in a broad sense -physical and human- and therefore higher growth (Kaldor, 1956, 1961). 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). On the other side, arguments can also be given to for inequality to represent a limiting factor for growth: 1) higher inequality implies higher socio-political instability and risk of violent conflict, which translates into uncertainty in property reducing investment and growth (Alesina and Perroti 1996). 2) It 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), which reduces average investment, especially in human capital (Galor and Zeira 1993), lowering long-run growth. 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 turns reduces growth; in particular, as the number of children per family increases, the average investment in education decreases (Barro 2000; Ehrhart 2009). Each of these channels will very possibly have a different explanatory power depending on the type of country; in particular depending on its level of development and on its initial income distribution.

[2] In particular, the high growth performance of East Asian countries that had relatively low levels of inequality has been compared to the rather weak performance of Latin-American countries that had persistent high level of inequality.

Focusing on the empirical evidence we can start by distinguishing time horizon differentials. It is important to notice that the factors that support a positive relation between inequality and economic growth are more likely to act in the short-run, while the factors that support a negative relationship are more likely to act in the long-run. Many are the authors who have focused on the long-run effects of income inequality on economic growth relying on cross-section analysis (Alesina and Rodrik, 1994; Persson and Tabellini, 1994; Clarke, 1995; Perotti, 1996; Temple, 1999; and Easterly, 2007)[3]. Their results coincide on finding evidence that income inequality has a negative and significant effect on subsequent economic growth and independent of the measure used and robust to possible data quality problems. Alesina and Rodrik and Persson and Tabellini argue that this negative effect is the result of redistributive pressures. Interestingly, Alesina and Rodrik´s results also indicate that countries that perform land reforms, which significantly improve wealth -as well as income- distribution, grow faster. Easterly differentiates between *market inequality* and *structural inequality*; theoretically, while the first one relates more to the short-run and can have positive effects on growth, the second one relates to the long-run and is unambiguously bad for subsequent development. However, Easterly, using factor endowment differentials across countries -in particular the exogenous suitability of land for wheat versus sugarcane, empirically focuses only on long-run-structural inequality. Since 1996, given higher data availability (thanks to Deininger and Squire, 1996)[4], some authors have analyzed the effects of inequality on growth using panel, instead of cross-country, data. Panel data can be more puzzling but also more enriching; its analysis allows differentiating short from long-run effects and controlling for time-invariant omitted variables. Focusing on how a 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).

As already mentioned, the effects of inequality on growth are also likely to differ between countries given the level of development (Partridge, 1997; Barro, 2000). This level is usually understood as 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[5]. He examines the effects of inequality on growth through the effects of the former on the fertility rate. Results give a negative correlation between initial inequality and subsequent growth. Gini coefficient is permitted to interact with the level of GDP (in log) showing that inequality is negatively correlated with growth in low income countries -per capita GDP below $2070 (1985 US dollars)- but positively correlated in high income countries.

[3] Benabou (1996) reviews some of the pre-1996 literature in depth.

[4] Deininger and Squire have compiled a data set on inequality measures for 108 countries.

[5] The independent variables used are the initial level of p. c. GDP (in logs), its square, the period average share of government consumption to real GDP, the period average share of investment to real GDP, the period average rate of inflation, the period average fertility rate (in logs), the period average growth rate of terms of trade, the initial level of year of schooling, rule of law index, a democracy index and its square. His panel is composed by data for 10 year periods from 1965 to 1995.

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 of East Asia and West Europe in 1970. [6]

Finally, Chen´s results suggest that increasing inequality is likely to have a different effect on growth depending on initial levels; for relatively equal countries, increasing inequality can foster economic growth, while a country with a high initial inequality can increase growth by redistribution of income. In fact, some authors argue that is changes in inequality, and not inequality levels, what we should look at (Banerjee and Duflo 2003).

To sum up, literature results tend to suggest that income inequality is positively correlated with subsequent economic growth in the short-run, but negatively correlated in the long-run. In parallel, inequality levels seem to be more harmful in low-income than in high-income countries. Additionally, increasing inequality is more likely to foster growth in initially equal countries than in initially unequal ones.

I.2. The effects of urbanization on subsequent economic growth:

Economic history tells us that urbanization, industrialization and economic development -through higher economic growth- tend to be parallel processes. Economic growth tends indeed to increase urbanization in almost any country. But a relevant question is whether and when geographic agglomeration of economic activity, which can be related to urbanization, fosters subsequent economic growth. The issue is a critical and current area of 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, pg 3]. Theory and evidence point towards a positive effect of agglomeration on economic growth. "Due to localized spillovers, geographical agglomeration fosters growth" (Dupont, 2007). Focusing on urbanization measures, some authors empirically show 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-

[6] Chen estimates growth including initial values of GDP, capital inputs (physical and human), institutional and policy's variable, and regional dummies. His sample includes data for 43 countries for 1970-1992.

[7] As Brülhart and Sbergami note, different spatial scales imply different mechanisms at work and, therefore, may yield different results. For small spatial scale, there are positive spillovers associated with clustering activities (mainly knowledge spillovers) and agglomeration may have a positive impact on economic growth even, at probably more importantly, in more developed countries.

enhancing effect of urbanization depends on the level of development; geographical concentration of economic activity favors growth in early stages of development -thanks to economies of agglomeration- but retards it in later stages -mainly due to diseconomies of congestion- (Williamson, 1965). Brülhart and Sbergami suggest a critical level of per capita GDP of US $10.000 (in 2006 prices) from which higher urbanization becomes 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, become significant for large urban agglomerations, rather than for small ones (Duranton and Puga, 2004; Rosenthal and Strange, 2004; Berinelli and Strobl, 2007).

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

I.3. The relationship between urbanization and income inequality:

The same evidence that supports the idea that urbanization can promote economic growth, at least in 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 urbanization processes. Classical dual-economy models of structural change show that inequality is somehow inevitable to the process of urbanization characteristic of economic development (Lewis, 1954; Harris and Todaro, 1976). These models try to explain how inequality rises with urbanization to then fall back. Two reasons to explain this inverted-U relationship between urbanization and inequality can be given. On one hand, the mean income differential between the agricultural sector and the urban sector, and the progressive migration from the first to the second, is enough to give the inverted-U relationship (Robinson, 1976; Knight, 1976; Fields, 1979). On the other hand, this relationship can also be explained by income differentials within the urban sector. For Harris and Todaro the constant inflow of workers allows for excess supply in the urban sector resulting in unemployment. Rauch (1993) modifies Harris and Todaro 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,

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Their results, however, relate to a higher spatial scale associated with urbanization, where the agglomeration impact relates to reduction of transaction costs and higher integration of markets.

[8] When urbanization takes place as a result of 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 retard economic growth. Bloom et al. (2008) compare industrialization-driven urbanization in Asia, likely to enhance economic growth, with urbanization due to population pressure and conflict in Africa, most likely detrimental for growth. Regarding Latin-American, the lack of proper urban planning is also evident in some countries (Angotti, 1996).

creating incentives to migrate even at risk of underemployment in the urban sector. Inequality falls back as urbanization increases; the exodus from agriculture raises rural wages -reducing inter-sector income differentials- and lowers willingness to migrate at risk of underemployment lowering underemployment itself -reducing intra-urban income differentials-. Rauch model helps as well, therefore, to explain the "rise and fall of urban slums" characteristic of the developing world.

Models of the New Economic Geography also help us to explain how the process of economic development comes with increasing urbanization and inequality in early stages of development. Agglomeration economies are the key element. Increasing returns of industrial activities, decreasing transport costs and labor mobility generate the concentration of workers and economic activity in the urban sector, allowing higher urban wages[9]. Economic growth is, thus, given by structural change in the economy that allows it to enjoy increasing returns and agglomeration economies. This structural change is given by the process of urbanization; as people and resources are reallocated from agricultural activities towards industrial activities. The process leads to increasing inequality, as higher incomes are perceived in urban areas compared to rural areas. Both, higher inequality and higher urbanization favor the concentration of production factors necessary for growth, and this concentration itself reinforces labor´s reallocation from the rural towards the urban areas (Ross, 2000). In later stages of development, however, urbanization is related to lower inequality; agglomeration economies get exhausted and congestion diseconomies become significant, the concentration of people in the cities raises rural salaries and all this reduces income differentials.

I.4. Policy debate:

The WDR 2009 goes in line with the argument of spatially unbalanced growth; economic growth is seldom balanced. Economic development is uneven across space and, therefore, will bring 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 to hand, the key element is the relation of forces between the three processes, at least as countries develop. In this sense, it might not be about inequality being good or bad for growth but that some degree of inequality is "natural" to the process of urbanization associated to growth.

However, some authors have recently highlighted 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). Regarding 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

[9] Dixit and Stiglitz (1977) and Krugman (1991) explain agglomeration due to increasing returns and decreasing transport costs.

development" (Barca et al. 2011). Moreover, increasing urban concentration might not necessarily be associated to the process of economic development. Interactions between economic geography and institutions are critical for development, as Barca et al. emphasize. In fact, that the process of urbanization -and the increasing inequality associated to it- can be modified by social and institutional factors has already been considered in the literature: the displacement of people and resources from the rural to the urban areas can be given 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 to, sooner or later, lead to congestion diseconomies, as already noted. Regarding developed countries, where institutions are relatively good, economic growth can be based on a different urban system[10]. The OECD 2009 report also highlights the idea that growth opportunities are both significant in big urban areas as well as in smaller more peripheral agglomerations.

By considering agglomeration and inequality processes, and their interaction, we can, therefore, differentiate development patterns based on countries´ characteristic conditions. 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 to increasing inequality, as suggested by the reviewed theory. We will see whether these processes are affected by country´s levels of income and inequality. In developed countries we expect the picture to be different, as suggested by Barca et al.: alternative urban structures, aside of merely increasing urban concentration, may offer greater opportunities for growth.

II. EMPIRICAL MODEL AND DATA

II.1. Determinants of Growth

Sala-i-Martin (2004) using cross-section regressions, and Barro (1998, 2000, and 2003) using panel data, have deeply analyzed the determinants of economic growth. Sala-i-Marti et al. (2004) explore 67 possible explanatory variables for long-run growth over 1960-1996 and find 18 that are significantly related to it. His results show that differences across countries in long-run growth of per capita GDP can be well explained using initial 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 specialization (it is found a negative and significant effect of 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". Following these works and in order to analyze the impacts of inequality on subsequent economic growth, we set an econometric model of growth that controls for conditional convergence, levels of human capital and investment. Other time-invariant country´s characteristics can be control for

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

using panel data techniques. This setting is common in the reviewed empirical work on inequality and growth (Alesina and Rodrik, 1994; Perotti, 1996: Forbes, 2000).[11] Along with measures of initial income inequality, we introduce measures of agglomeration to analyze effects on economic growth and to also -in section IV- analyze how the two processes (using changes rather than levels) interact with each other.

II.2. Data

As all the authors that have approached the subject notice, inequality data is scarce. This scarceness, and data quality concerns, seems to have conditioned the analysis of the effects of inequality on economic growth. Moreover, inequality can be measured with different indicators (Gini coefficient, Theil index, quartiles share, etc). The main and most complete dataset on Gini coefficients comes from the World Income Inequality Database (WIID-WIDER). However, different Gini coefficient primary sources use different raw data to construct the index. Besides quality, there are three factors to take into account: 1) the object of measure -that can be gross income, net income, expenditure or consumption-, 2) the unit of measure -individual, family or household-, and, 3) the coverage of data -urban, rural or all-. According to Knowles (2001) it is best to use net income, expenditure or consumption, as the explanations of the effects of inequality on growth relate to income distribution after redistribution has taken place. Data on Gini coefficients based on expenditure or consumption is scarce, moreover in developing countries. Therefore, data based on net (or disposable) income should be preferred, that measures household or family income and with total population coverage.

Given this variety of data, some authors adjust data to try to solve for significant differences, while others prefer to use unadjusted data. Clarke (1995) finds that the correlation between inequality and growth is not fragile despite data concerns. He uses unadjusted data, pre and post tax (choosing pre-tax data when available and household data if possible), for his cross-section analysis. To account for measurement errors, he uses a two-stage least-squares instrumenting for the inequality measures and conducts sensitivity analysis. Barro (2000) also uses unadjusted data, but he uses dummies to control for differences in the method of measure for the Gini. However, more recent empirical work (i.e.: Gruen and Klasen, 2008) worry about the use of unadjusted data. For the analysis done in this work, given the complexity of the data problem and acknowledging recent concerns about the use of inequality data in previous literature,

[11] 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. Perotti, on his side, includes as control variables 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 uses Perotti specification but uses panel data. Other authors include more control variables. Clarke´s cross-section work, 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.

we follow Gruen and Klasen and use their coefficients.[12] These come from the WIID database, are adjusted for different possible object of measure, and relate to households or families and for the entire population. These data have been already used, for instance, by Atkinson and Brandolini (2010).

We use GROWTH, as our dependent variable, which reflects 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 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 proportion of total population (URB_1M), which captures urban concentration.[13] A table with all the variables used and their sources is the annex 1.

Our sample includes 51 countries with data for 1970-2007, taking data for 1970, 1980, 1990 and 2000 to explain growth in each subsequent decade in the panel. The selected countries are those for which reliable data for all the variables used here have been found. A list of the countries considered is the annex 2. The sample, although relatively small, includes major countries from all different world regions, is bigger than most previous works´ samples and gives enough information for the purpose of the work.[14]

Table 1 shows descriptive statistics for main variables. The variance of each variable can decomposed into *between* variance, which reflects the variance between countries, and *within* variance, which reflects the variance over time within countries. The variation of the variables in levels tends to be more attributable to cross-section differences between countries. If we take the variables in changes, however, both the between (cross-section) and within (over time) variation are more balanced.

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

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[12] Some missing values for Gruen´s Gini coefficients have been filled taking trends and/or interpolations: Bolivia 1980 y 2000, Ecuador 1980, Egypt 1980, Honduras 1980, Korea 1980, Nepal 1990, Peru 1980 South Africa 1980, Tanzania 1980 and Zambia 1990.

[13] We wanted to try other measures of agglomeration at country level. Aside from urbanization and urban concentration measures, we also considered the share of population concentrated in the largest city (PRIMACY). We also considered two more variables used in related literature: the geographic concentration of population (GEO_CONC) and the average population by squared km (DENSITY). We present only results for *URB* and *URB_1M*, which capture agglomeration of population but also of economic activity. The other variables are more related only to agglomeration of population and, therefore, seem to relate less to our analysis.

[14] 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: 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
ΔINEQUALITY	1.0098	6.1005	2.4285	5.6032	19.9000	-22.2000
ΔURB	4.3771	3.5829	2.7819	2.2803	17.1000	-4.6000
ΔURB_1M	1.3159	1.9985	1.4792	1.3546	10.8242	-6.6017

Included observations: 204 for variables in levels, 203 for variables in changes.

Table2: 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 correlations among our variables, while annex 4 presents scatter plots of variation (overall, between and within) among INEQUALITY, URB, URB_1M and GROWTH. Taking a first approximation at the data there are some things that are worth noticing. Focusing on the variables in levels: inequality is negatively correlated with subsequent economic growth (-0.22), using raw data, but that the value decreases (-0.11) when we control for time and country effects -adjusted data. Both urbanization measures (URB and URB_1M) are highly and positively correlated with income while they do not seem to be significantly correlated with economic growth. Finally, according to raw data, inequality is significantly and negatively correlated with income and urbanization. A closest look at the scatter plots, nevertheless, shows an inverted-U pattern between urbanization and inequality; inequality seems to increase at early levels of urbanization and decrease later (similar to the pattern described by Kuznets between income and inequality). From a deeper analysis of data, it is also worth noticing relevant differences among countries from different continents; Latin American countries, for instance, present much higher levels of inequality than countries from other continents with similar levels of income and urbanization.

Focusing on the variables in changes: there is no significant correlation between growth and change in any of the two urbanization measures or change in inequality. Additionally, inequality does not seem to increase more in countries where increasing urbanization or increasing urban concentration is higher. However, and taking into account non-linearity in the scatter-plots of annex 4, we can analyze the data distinguishing countries based on income and inequality levels (high or low, comparing country´s levels to the period medians). Annex 5 presents these correlations by income and inequality levels. We now see that a positive change in INEQUALITY is positively correlated with subsequent GROWTH in low-income countries, especially (0.36) in low-income-low-inequality ones; countries like China, South Korea (in the 70´s and 80´s) or Morocco (in 2000´s). Regarding 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 countries like China, South Korea or Morocco, but also others like Bangladesh or Tanzania (in 2000´s). By contrast, the same correlation is significantly negative (-0.31) for high-income-high-inequality countries, among which we can find Colombia, Peru and South Africa (also developing countries but still of relative high income). Most developed countries classify as high-income-low-inequality countries. For them, increasing INEQUALITY or increasing URB_1M does not show a significant correlation with GROWTH.

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

III. ESTIMATION AND RESULTS

We use panel data based on four periods: 1970-1979, 1980-1989, 1990-1999 and 2000-2007.[15] Our starting point will be an econometric model of growth as stated before, controlling for conditional convergence, levels of human capital and investment, and introducing measures of inequality and agglomeration:

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

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

Three main econometric problems arise from estimating (1): 1) GROWTH is calculated from per capita GDP, our variable for income. Because of 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

[15] Other authors (Barro, 2000; Forbes, 2000) also use ten years periods. As they note, first, higher frequency data for inequality is very scarce, and second, for less than ten years the within countries variability of income inequality is very low, while growth variability may be too large.

period as a first measure to avoid reverse causality and reduce possible endogeneity concerns.[16] 2) The second problem is the existence of unobserved time-invariant country characteristics, which are contained in the error term, and make OLS estimators inconsistent. Random Effects (RE) estimations allow us to control for unobserved country specific effects and retains cross-sectional differences, important in our analysis given that the variance of our variables of analysis (inequality and agglomeration) is mainly cross-sectional. However, if the country effects are correlated with the regressors -which is very 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 considers only within variation. 3) The last problem is the presence of initial income as a regresor in (1) making it a dynamic panel model. To see it we can rewrite equation (1) as:

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

FE estimations of this type of models suffer of dynamic model bias when the number of periods is small, as is our case. 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 change main results in most of the related works. In that way, OLS regressions of accumulated growth rates over initial values of explanatory variables can be interpreted as measuring the long-run effects of those variables on subsequent economic growth, 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 coefficient only reflect within-country time-series variation, they can be interpreted as short-run effects. However, one might still worry about dynamic panel bias. Consistent estimation can be done by 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 is our case).

In table 4 we present all different estimators of model 1: OLS, RE, FE and Sys-GMM. We use URB_1M as variable for agglomeration. In table 5 we present the same estimations but using URB instead. In all estimations period dummies are used to control individual time effects. OLS, RE and FE estimations are made by GLS with robust standard errors. Sys-GMM is made by two-step estimation using Windmaijer´s (2005) finite sample robust error correction.

[16] Later on we will look at the possibility of endogeneity of the used regressors.

Table 4: 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 5: 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 in 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 Sys-GMM estimation (where per capita GDP, rather than its growth rate, is the dependent variable). Higher human capital levels and lower initial price of investment increase long-run growth. Regarding agglomeration and inequality measures results differ between estimations. In the OLS and RE, urban concentration (URB_1M) is positively significant -table 4- while urbanization (URB) is not -table 5.[17] Inequality levels show, as it has been found before in the literature, a negative and

[17] From the 5 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.

significant effect on subsequent long-run economic growth. By contrast, in FE estimation, both agglomeration and inequality become insignificant. But FE only takes into account variation over time within countries; results could suggest that the effects of inequality on subsequent economic growth change in the short-run compared to the long-run (as in Forbes 2000). Finally, we focus on Sys-GMM estimation given the possible problems of the OLS, RE and FE estimations. Sys-GMM results indicate a significant positive effect of urban concentration (URB_1M in table 4); higher levels of urban concentration seem to foster growth -in line with Berinelli and Strobl 2007. Inequality, on its side, is negative and significant on subsequent economic growth.

IV. CHANGES IN INEQUALITY AND AGGLOMERATION, AND GROWTH

As noted in section 2, some authors argue that it is the *change* in inequality, not only the level of inequality, what matters (Chen, 2003, Banerjee and Duflo, 2003). In addition to considering the effects of inequality and agglomeration levels, we could therefore also consider the effects of their increase. 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 set different models considering *changes* in inequality (country´s growth of inequality in the previous ten years) as well as *changes* in agglomeration (country´s growth of agglomeration also in the previous ten years) and interaction terms between both processes. We focus on urbanization and urban concentration measures as they seem to provide more interesting information.

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

Table 6: Estimations using *URB_1M* 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)	0.8238	(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 7: 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%.

Results using urban concentration -table 6- show: 1) growth in agglomeration -measured as the within country´s change in URB_1M- seems to be have a significant effect but depending on the level of development; there is positive effect at early stages of development -low income- but a negative effect afterwards (specification 4). Actually, the significance of the positive effect disappears not only when income levels are already high but also when inequality levels are (specification 5). Moreover, it is only when both, income and inequality, 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 unequal countries (specification 6). 2) Regarding increasing inequality, the coefficient for the change of 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 for agglomeration, we use urbanization -table 7- we get slightly different results. In this case, although higher initial levels of urbanization do not seem to affect growth -as we saw in table 5 results-, the coefficient for increasing urbanization -within country change in URB- is positive and significant (specification 1 and 2); the process of urbanization seems to be good for growth. However, again, that positive effect is no longer significant when inequality is high (specifications 5, 6 and 7). Regarding increasing inequality, it seems to have a significant positive effect on growth but again only in low-income-low-inequality countries (specification 6 and 7).

How can we compare results from table 6 with those from table 7 and what are these results telling us? High urban concentration levels seem to be positively related to subsequent economic growth, while urbanization levels do not seem to be significant. However, it is possible that for small to medium size cities (when higher urbanization does not necessarily imply higher urban concentration at country level) the process of increasing agglomeration, rather than its level, is indeed positively related to growth, and this happens particularly as long as inequality levels remain relatively low. Moreover, a key difference between results with URB than those 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 significantly positive only for low-income countries and can degenerate in congestion diseconomies in high-income ones.

Our results seem to support the WDR 2009 view that urban concentration is accompanied by growth. But our results also support the OECD 2009 ideas. Urban concentration might be the only realistic option for growth in developing countries because they lack the proper institutional environment. In fact, there is a risk of congestion diseconomies behind increasing urban concentration when there is high inequality, what we interpret as a weak institutional environment. For developed countries, most of them endowed with low inequality levels and with strong institutional environments, there might be higher growth opportunities in a more diverse urban system -which does not rely only on increasing urban concentration. The highlighted relevance of inequality levels seems indeed to be determinant. The effects of increasing urbanization (in low as in high-income countries) and of urban concentration (in low-income countries) will be positive in low inequality countries, most probably endowed with good institutions. In relationship to the policy debate regarding the benefits of a more o less urban concentrated pattern of development, therefore, it seems clear that the stage of development the country is at (in our work reflected in levels of income and levels of inequality) is fundamental for any analysis.

V. 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 over time within countries, as well as the interaction between both processes. Regarding levels, on one hand, and as suggested by previous literature, our empirical results show that high inequality levels seem to limit growth in the long-run. On the other hand, also as suggested by previous literature, urban concentration fosters growth; the possibilities for higher growth can be associated to the potential growth-enhancing agglomeration economies that countries experience as economic activity concentrates at the urban level. Regarding the process of increasing inequality and agglomeration (the variables in changes rather than in levels), initial conditions seem fundamental; whether the country is relatively poor or rich and whether it is relatively equal or unequal. Interactions between economic geography and institutional factors (in our case inequality) are indeed relevant. On one side, increasing agglomeration -be it increasing urbanization or increasing urban concentration- fosters growth in low-income countries. On the other side, only increasing urbanization, not increasing urban concentration, seems beneficial for high-income countries. The key result is that for both types of countries, the positive effects of agglomeration depend on low levels of inequality. When inequality becomes too high the benefits vanish and increasing urban concentration can even degenerate in congestion diseconomies in high-income countries.

The policy implications differ according to the level of development. For low-income countries, on one hand it has been argued that these countries should pursue growth first and then, just when growth is secured, attend distributional aspects; the recurrently argued trade-off between efficiency and equity in economics. This acknowledges the empirical fact that growth is by nature, and at least in the short-run, uneven and spiky. This unevenness is crucially spatial too; associated to the geographic concentration of economic activity (WDR 2009). On the other hand, however, it seems also quite clear that inequality becomes, sooner or later, a handicap for growth; developing countries that face high income inequalities are indeed also facing greater obstacles to achieve sustained long-run economic growth. Both facts together mean that while achieving higher economic growth may imply higher inequality due to higher geographic concentration of economic activity in the short-run, it also implies efforts for better income distribution in the long-run as a reinforcing, instead of confronting, objective to economic growth. For high-income countries congestion diseconomies seem to be a relevant issue to be addressed. A more balanced urban system, where small to medium size cities play a fundamental role by mobilizing local assets to exploit local synergies, seem to be a better strategy than intense urban concentration (OCDE 2009). Finally, the fact that the benefits from agglomeration seem to depend on income distribution is likely to be signaling the relevance of good institutions in the process of development, in particular in what relates to economic geography. Surely the topic deserves more analysis and further research.

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Annex 1: Variables used:

Variable	Description	Source	Notes
GROWTH	Accumulated anual 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	Missing values for MDG and NGA filled using "IIASA/VID Projection"
INEQUALITY	Gini coefficient	Gruen and Klasen 2008	Missing values filled taking tends: BOL 1980 y 2000, ECU 1980, EGY 1980, HND 1980, KOR 1980, NPL 1990, PER 1980 ZAF 1980, TZA 1980 and ZMB 1990.
URB_1M	Population in agglomerations of more than one million as percentage of urban population.	World Bank	
URB	Urban population as percentage of total population	World Bank	
PRIMACY	Population in largest city as percentage of urban population	World Bank	
GEO_CONC	Geographic concentration of population	Collier 2009	
DENSITY	Average population by squared km of land.	World Bank	

Annex 2: 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

Annex 3: Correlations:

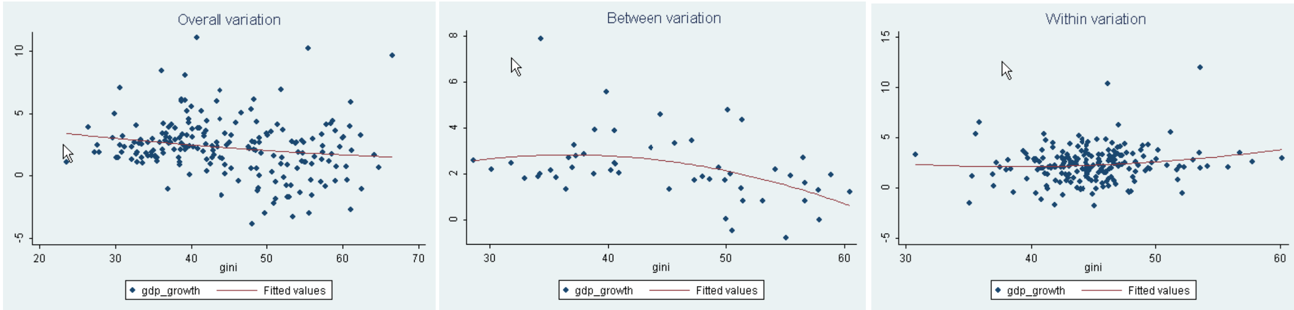
	GROWTH		LOG_PCGDP		INEQUALITY		URB		URB_1M		SCHOOLING		PI		ΔINEQUALITY		ΔURB	
	raw data	adj. data	raw data	adj. data	raw data	adj. data	raw data	adj. data	raw data	adj. data	raw data	adj. data	raw data	adj. data	raw data	adj. data	raw data	adj. data
GROWTH	1.000	1.000																
LOG_PCGDP	0.026	-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 is obtained eliminating time and country effects. Included observations: 153 (51 countries times 3 periods)

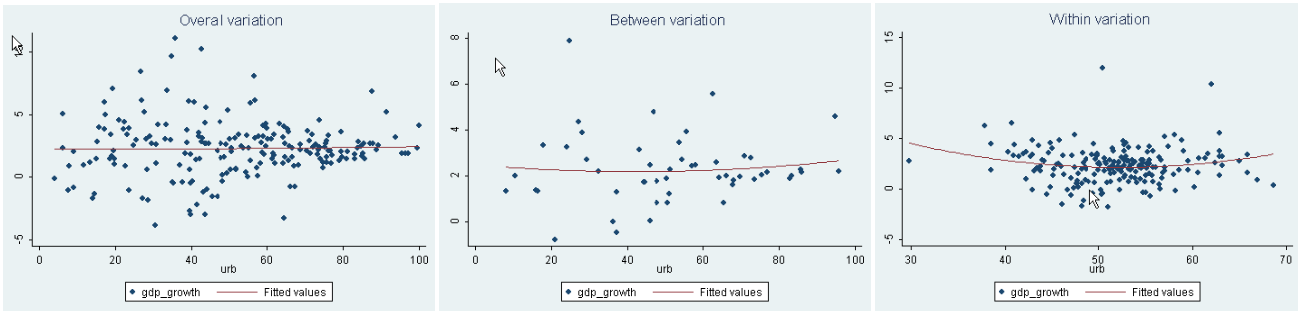
GROWTH is measured between t-1 and t. Other variables in levels are measured at t-1. *Δ* represents change between t-2 and t-1.

Annex 4: Scatter plots among key variables

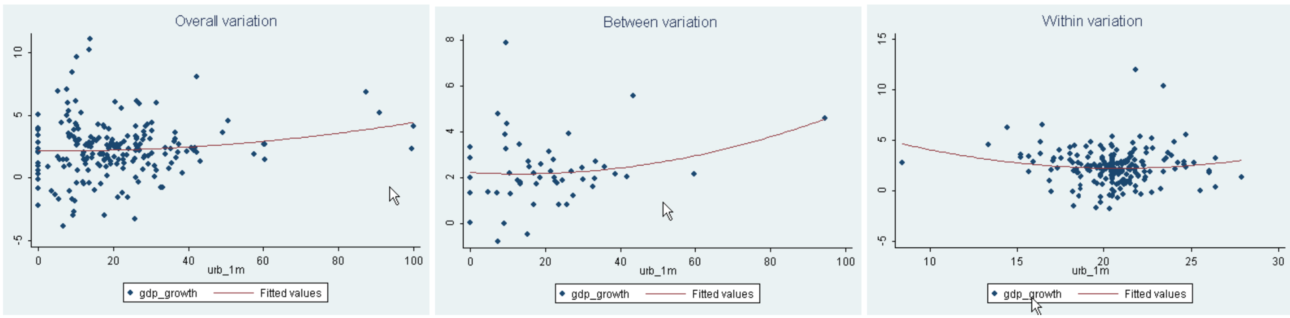
INEQUALITY vs GROWTH:



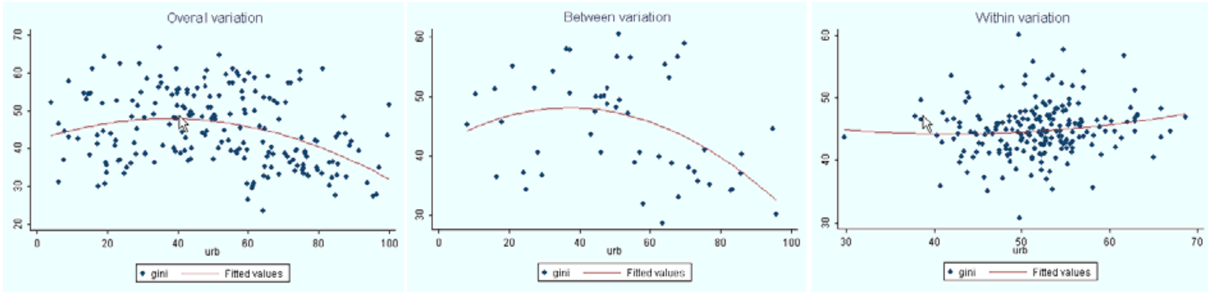
URB vs GROWTH:



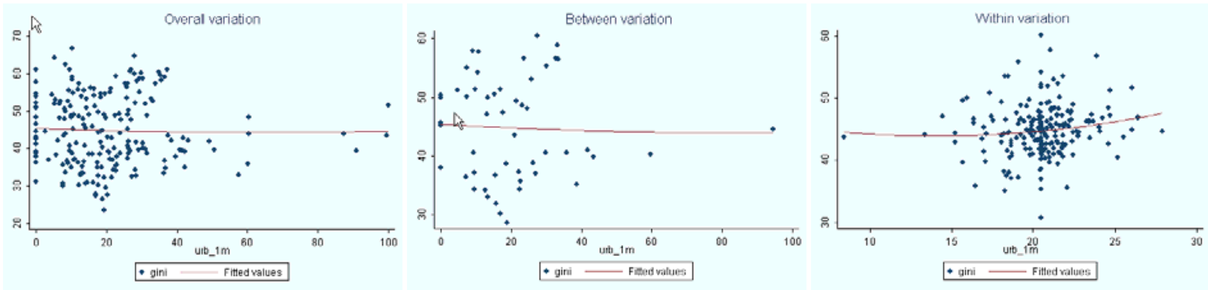
URB_1M vs GROWTH:



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