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The Dimension of Cities Revisited: Patterns of Urbanization Processes and Performing Urban Structures

by

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To my father, who passed away
during this time.

Abstract

In this research we analyze the main drivers of the growth of cities, according to their sizes: Mega, Big, Midsize, etc., applying a cross-country analysis that involves about 114 countries in a period of time of forty years (1960-2000). We have tried to find the differences in the underlying factors of cities growth particularly among large agglomerations, which are attracting great interest among policy makers. Secondly, we have tried to verify if the growth of cities is linked to urbanization processes that encompass economic structural transformations (performing urbanism), or if their growth is linked to dynamics that disadvantage further economic development (non-performing urbanism). Once considered the relation between the evolution of cities sizes and the shape of the urban structure (using the Zipf's parameter and other urban variables) we analyze the quality of this structure as a "new" deep determinant of economic growth. This is why, in the last part of the research, we look for possible relations between the quality of the urban structure and economic growth. Our results indicate that growth in very large agglomeration tends to be "non-performing" and that the urban structure which fits better with economic growth is characterized by high urbanization rates but low hierarchical structures. We are aware of the fact that the relation under analysis could conceal problem of endogeneity that will need further research.

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Preface

> "…a great city is not to be confounded with a populous one. Moreover, experience shows that a very populous city can rarely, if ever, be well governed (…). To the size of states there is a limit, as there is to other things, plants, animals, implements; for none of these retain their natural power when they are too large or too small, but they either wholly lose their nature, or are spoiled. For example, a ship which is only a span long will not be a ship at all, nor a ship a quarter of mile long; yet there may be a ship, but bad for sailing." (*Aristotle,* Politics, Book VII, Part IV.)
>
> "*Stadtluft macht frei*, aber nicht jede Luft ist gesund." (*Anonymous*[1]).

The motivation of this research arises from the personal experience of living for many years in a city that transformed its size from a relatively small town to a mega city, becoming a dynamic urban center which combined both economic progress and social distress. The old downtown and new business districts were surrounded by slums, increasing the contrasts in the urban space. This observation was not isolated, it became a typical representation of other large agglomerations around globe.

From these facts several questions came up, particularly regarding the drivers that impel the quick growth of cities, with the associated increasing hierarchization of the urban structure, where a primate city dominates the urban landscape giving little economic and social space to other city sizes.

Consequently, this study states two initial questions that will accompany us through all our research: (1) Which are the main drivers that affect growth in different dimension of cities, particularly among large agglomerations? (2) Is there any link between the characteristics of the urban structure and economic growth?

To give a consistent answer to these fundamental questions, two key elements would be required: (1) a strong interdisciplinary approach, which takes into consideration historical, geographical, sociological and institutional elements, and (2) appropriate data to capture real city sizes, as well as, adequate explanatory variables.

Regarding the first element, we have tried to include in our economic models historical and institutional variables; however we realized that these are limited by

[1] The air of the city makes you free, but not all air is healthy (our translation).

data scarcity and potential econometrical problems. This is due to inherent limits in capturing complex historical and institutional processes through very simple indexes, which can strongly simplify the rich structure of relations between urban, economic, historical and social dimensions that only different approaches and methodologies can manage.

The second element (quality and availability of data) is also challenging, because most available data (particularly in developing countries) on cities sizes use the physical criterion to define their extent (urban agglomerations), which is not the most appropriate methodology to capture the real dimension of cities, as we will comment in Chapter 1. Additionally, the use of national variables to explain the dimension of cities (as in Ades and Glaeser, 1995) presents limits and endogeneity problems which are difficult to resolve.

Although these limits, which most are due to data scarcity, the understanding of complex relations between urbanization and economic growth is capturing the attention of several scholars and the discussion about which urban structure fits better for economic growth is increasing particularly among developing countries. These issues cannot be ignored and require further studies.

To afford these challenges, our research is organized in three chapters:

The *first chapter,* after a short discussion about the population growth in the long-run, reviews the process of urbanization growth over the years from 1960 to 2000, analyzing both the urbanization trends of this period, in a context of demographic transformation, and the links between population and urbanization growth. This inquiry allows to observe the patterns of urbanization growth, which are the starting point of our thesis.

The second part of the chapter is focused on the urban structure, which regards the different characteristics of the urban setting supporting the spatial distribution of urban population, economic activities and administrative functions. We analyze the different ways to capture its characteristics.

The third part studies the growth of cities of different sizes at a global level, both in number and in their average dimension, using a classification proposed by United Nations.

The fourth part studies, in more detail, the transformation of the different categories of cities and their growth paths that can be associated to different regions of the world. Finally, we analyze the relation between primacy and spatial variables.

The main outcome of this first chapter is a general overview of the transformation and growth of urban structures and of the dimension of urban centers according to their size.

The *second chapter* is focused on the literature review. In this chapter we try to understand models and theories of urban growth and decline; considering the main contributions of the Economic Geography and New Economic Geography schools. This chapter is organized in five parts.

The first part studies the phenomenon of the city, considering its concept from the perspective of different disciplines. The second part analyzes spatial externalities in the classics, from Marshall and Von Thünen to Scitovski. The third part assess the main recent contributions on centripetal and centrifugal forces in shaping urban structure and city sizes among developing and developed countries. The fourth part is a review of prominent empirical studies on main cities growth and primacies. Finally, we assess the possible links between "deep determinants of growth" and urban structure and the empirical contributions on the field.

The *third and last chapter* tests empirically the two main questions previously stated, using a dataset that we have prepared (urban dataset). Firstly, we study the main drivers that impel growth in main cities, considering also the income level of the country to which they belong. We began re-analyzing the contribution of Ades and Glaeser (1995) with data for a longer period. Secondly, we analyze the growth patterns of large agglomerations (Mega and Big cities) to understand if the drivers that impel their growth differ from those of cities of different size. We apply the mentioned theoretical framework and the one used by Davis and Henderson (2003) to understand the growth of Midsize and Small cities, due to their importance in maintaining a sustainable urban structure.

In the second part of this third chapter, we undertake a new issue: that is an analysis of the effects of the urban structure on economic growth. Usually, the urban structure has been considered a "pure endogenous" element; however, once established, it can generate a sort of feedback effect on economic growth. This assertion raises the question if the urban structure can be considered an element that belongs to the "deep determinants of growth", due to the fact that economic activities are becoming more and more urban-based. Therefore, we explore the possible links between the (quality of) urban structure and the economic growth. Without pretending to make an exhaustive analysis, we try to verify the existence of some evidence that can support further studies about this important issue.

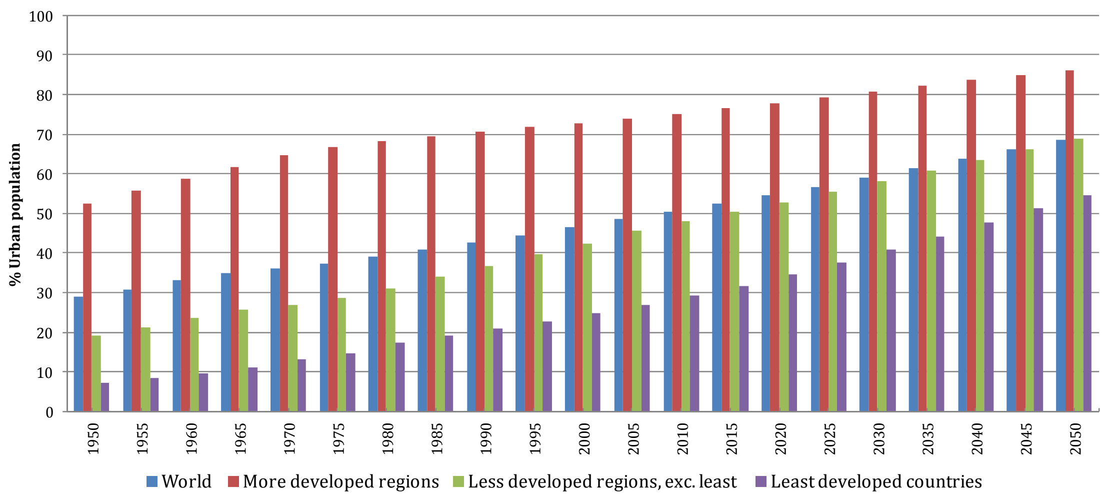
1. The Urban World: Facts and Trend of Global Urbanization

1.1. Introduction

In 2008, for the first time in history, the percentage of world's urban population surpassed the rural population[1]. According to the forecast of United Nations, the mentioned trend will continue to increase in all the regions without exception, although the differences in their income level. This would imply that by the year 2050 the world's urban population would reach 70%. In this scenario, more developed regions will continue to lead urbanization rates, reaching a level of urban population of 85 %, followed by less developed regions with 65 % and least developed regions with 55 %.

As it can be observed in Figure 1.1, there is an apparent relationship between the level of urban population and the level of economic development, fact that may indicate an opportunity for developing countries which transforming their rural space into a more urban one, they could improve their productivity and economic growth.

Figure 1.1. Percentage of urban population and estimates (1950-2050)



Source. World Urban Prospects 2009. Our elaboration

Nevertheless, the relationship between urbanism and economic growth is complex. High urbanization rates not always are related to high income levels and adequate standards of living. A simple observation of urban areas, particularly among

[1] The glossary of UN World Urbanization Prospects (2010) classifies the world population in two main groups: Rural and Urban Population. Urban population regards *de facto* population living in areas classified as urban according to the criteria of each country, meanwhile rural population is *de facto* population living in areas classified as rural, which it's the difference between the total population of a country and its urban population. The Population Reference Bureau refers that although the different country classification of rural and urban, a typical definition of urban refers to settlements with 2,000 or more people.

developing countries, shows that high levels of urbanism are also related to high economic inequality, precarious housing, violence, pollution and increasing costs of living.

This striking urbanization process has attracted since years the attention of researchers; Hoselitz (1957) calls "hyper-urbanization" when rural-urban migration grows at a higher rate than employment in cities, explaining why it's possible to observe countries with an extended urban population but with few workers in the manufacturing sector. Wolman (1965) observing the environmental effects of raising agglomerations, proposed the first model of "urban metabolism" to reduce the water consumption and air pollution in cities. Under the same perspective Schumacher (1975) considered that there is no future for megapolis due to their non sustainable demand of oil-based energy. As a matter of fact, cities today consume 75% of the global energy and represent 80% of the global emissions of harmful greenhouse gases (Siemens AG, 2010); holding more than 50% of the global population, they only occupy approximately 3 % of the terrestrial surface (GRUMP[2], 2011).

Under a different perspective, Eckstein (1977) studied how rampant urbanization is related to economic marginalization. He observed the problems that new urban settlers afford in entering the formal economic sector. As a consequence, informal activities turn into the main subsistence employment, creating an active economic and social parallel world, as De Soto (1986) underlines; however the informal sector is not able to offer a secure path to development.

Table 1.1 indicates the slope of the tendency line of the increasing urban population level in last 40 years, which gives an idea of the urbanization process among different regions. It is interesting to observe that the highest slope does not belong to Least developed regions but to the Less developed ones[3].

Table 1.1. Slope of tendency line of urban population levels (1960-2000)

Areas according development level	**Slope**
Less developed regions exc. Least dev.	0,48
Least developed regions	0,39
More developed regions	0,34
World	0,33

Source: UN World Urban Prospects (2009); our elaboration.

These differences could be explained by the effect of an emergent capitalist sector within urban areas, which implies the change from an agricultural based economy

[2] For more details see the Global Rural Urban Mapping Project (GRUMP), Columbia University. http://beta.sedac.ciesin.columbia.edu/gpw/

[3] According to the United Nations (2001), Least developed countries include 49 countries: 34 in Africa, 9 in Asia, 1 in Latin America and Caribbean and 5 in Oceania. Less developed countries present a better level of economic development that Least developed ones.

to an industrial one (Lewis, 1954; Henderson, 2000); this phenomenon tends to be more dynamic among less developed regions than among least developed ones.

Several other arguments emerge when the increasing spatial concentration of people and their links with economic development are studied; this phenomenon requires a deeper analysis in the dawn of the XXI century, which has been called as the “urban century” by UN-Habitat

To offer a first approximation to this issue, the present chapter is organized in five parts. The first part analyzes the patterns of population and urban population growth considering long periods of time; this will contribute to focus the current urban phenomenon within the evolution of the world’s population. The second part analyzes the different patterns of urbanization among the world’s regions. The third part analyzes the concept and characteristics of the urban structure and its evolution between the years 1960 and 2000. The fourth part analyzes the links between the urban structure and spatial variables. The fifth part explores the possible relations between the urban structure and the economic growth.

Finally, it’s important to mention that a dataset composed by 14 different data sources has been built, providing suitable economic, geographic, geo-economic and institutional data that allows the exploration of the urban global structure and its links with economic growth. The dataset has been named “**Urban dataset**”: its description is available in Appendix 1.1.

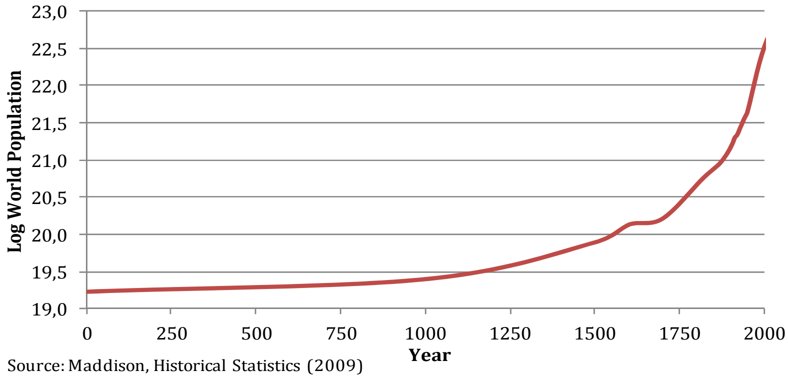
1.2. Population Trends in the Long Run

To focus properly our study, it’s necessary to locate the urban phenomenon inside the frame of population growth, which has shown a jump without precedents in history (see Figure 1.2). Until the XVII century, the world experimented a sort of stability on its population; it was in the XVIII century when the population growth “took off” reaching its maximum level in second part of the XX century.

It’s interesting to observe (see Table 1.2.) that in the year 1 AD the global population corresponded 21 times to the current population of Greece. The population only doubles after 1500 years. Later on, the rate of growth speeds up arriving to triple the population in 70 years.

Nowadays, the world’s population is about 630 times the current population of Greece. To review in detail how this process occurred, Tables 1.3 and 1.4a present a synthesis of the world’s population distribution in 7 regions and its growth since the beginning of the Christian era.

Figure 1.2. World population (1-2009)



Source: Maddison, Historical Statistics (2009)

Table 1.2. World population growth in the long run

Year	Range in years	Word population (millions)	Rate of growth World pop.	Pop. Equival. (1= 10.7 mill. people. Greece pop. 2009)
1		225.820		21
1000	1000	267.330	18%	25
1500	500	438.428	64%	41
1600	100	556.148	27%	52
1700	100	603.490	9%	56
1820	120	1.041.708	73%	97
1870	50	1.275.732	22%	119
1900	30	1.563.464	23%	146
1920	20	1.863.466	19%	174
1940	20	2.299.193	23%	214
1950	10	2.527.960	10%	235
1960	10	3.041.507	20%	283
1970	10	3.691.157	21%	344
1980	10	4.439.529	20%	413
1990	10	5.269.029	19%	491
2000	10	6.076.558	15%	566
2009	9	6.764.086	11%	630

Range in year	World pop. growth in the period
1 to 1000	18%
1000 to 1500	64%
1500 to 1700	38%
1700 to 1820	73%
1820 to 1940	121%
1940 to 2009	194%
1 to 2009	2895%

Source: Maddison, Historical Statistics (2009); our elaboration.

As a general overview, these regions can be classified, according their historical share of world's population, in three main groups (large, middle and small share of population). The first group corresponds to Asia, which holds more than 50% of world's population; this region only reduces its share in some points in the XX century. In the second groups we can situate Western Europe and Africa; their shares of world's population are quiet similar until the second half of XX century, when Europe experimented a decline and Africa an increase in its population. In the last group (small share) we find Latina America, Former Russian countries, Eastern Europe and Western Offshoots (USA, Canada, Australia and New Zealand). By centuries Western Offshoots had the smallest share of world's population, but since the XVIII century until the Second World War they reached the highest rate of population growth in the world (see Table 1.4b).

Analyzing in more detail the rate of population growth, we verify that the only period that presents a negative rate is between 1500 and 1700, which coincides with the colonization of the New World. During this period Western Offshoots presented a rate of population change of -38%, meanwhile Latin America -31%. Many of these changes in population have been explained by diseases such as smallpox, yellow fever and malaria, Cook (1998) among others.

Nonetheless, the rate of growth for this period in Africa surprises, it continued to be positive and relevant (31%) although the trade of slaves. A possible explanation of this difference is given by Nunn and Qian (2010) who indicate that the "Columbian Exchange" (exchange of diseases, ideas, food crops and population between Europe and the New World) was less intense in Africa and Asia. Moreover, they argue that the main reason behind the reduction of diseases' impact on these two areas was the discovery of quinine in the New World, which kept them out of strong population declines.

The population recovery among Western Offshoots and Latin America began in the XVIII century and in the forthcoming years the rate of population growth achieved great intensity. Nowadays, the most populated regions are the less developed: Asia, Africa and Latin America, which continue to lead the world's population growth with extraordinary rates, in spite of the increasing migration to more developed regions. This fact has raised several questions about the relationship between population growth and economic growth.

Solow (1956), in his famous growth model, took into account the effects of the population expansion in processes of capital accumulation and economic growth. Hirschman (1958) argued that population growth may induce economic development due to its effect on market size, economies of scale and incentives to increase innovation with the aim to improve economic efficiency per capita.

Even so, spatial economists, starting from the contributions of Von Thünen (1826) and Marshall (1890), have been more focused on the effect of urbanization on economic growth, analyzing the different types of externalities that can generate agglomerations, propelling the interaction between economic agents. This fact enhances innovation, technological learning, productivity and growth, creating a virtuous process that attracts more workers and increases the size of the agglomeration, expanding the possibility to increase the economies of scale.

In this theoretical framework, Henderson (1974; 2004) emphasizes the existence of a connection between urban population and economic growth, because usually production occurs in cities. For Henderson –following Marshall (1890)- the particularities of spatial externalities create different specialization of industries which induce cities specialization in certain industries. However, because of the diseconomies of city sizes, it is not rational to locate in the same city industries which do not share mutual spillovers:

> "…steel production and publishing generate few mutual external economies, steel mills and publishing houses should be in different cities, where they do not generate congestion and high land rents for each other. So each city should be specialized (at least in its "export" industries) in one or a few industries that create external economies. Second, the extent of these external economies may vary greatly across industries: A textile city may have little reason to include more than a handful of mills, whereas a banking center might do best if it contains practically all of a nation's financial business. So the optimal size of city wills depend on its role" (Fujita, *et. al.*, 2000:20).

As a corollary, it would be reasonable to expect the presence of large inefficiencies among certain types of cities that contain, in the same urban space, several industries with few mutual external economies, as many emerging mega cities present. This fact motivates different questions regarding the effects of the urban structure on economic growth.

From this surprising change of world's population some key questions arise: (1) How are currently distributed the urban settlers? (2) Which are the levels of urban population in world's regions? (3) How are evolving the urban growth rates? (4) Is there a common pattern between the level of urban population and the level of economic development? These are questions that we will analyze subsequently.

Table 1.3.World population (thousands) by regions

Year	Western Europe	Western Offshoots*	Eastern European	Former USSR	Latin America	Asia	Africa	World
1	25.050	1.120	4.750	3.900	5.600	168.400	17.000	225.820
1000	25.560	1.870	6.500	7.100	11.400	182.600	32.300	267.330
1500	57.268	2.800	13.500	16.950	17.500	283.800	46.610	438.428
1700	81.460	1.750	18.800	26.550	12.050	401.800	61.080	603.490
1820	133.028	11.231	36.457	54.765	21.591	710.400	74.236	1.041.708
1940	293.568	153.003	93.982	195.970	129.946	1.238.924	193.800	2.299.193
2009	402.418	366.175	120.154	283.290	583.991	4.017.611	990.447	6.764.086

* Australia, New Zealand, USA and Canada

Source: Maddison, Historical Statistics of Maddison (2009); our elaboration.

Table 1.4.a. World population percentage by regions

Year	Western Europe	Western Offshoots*	Eastern European	Former USSR	Latin America	Asia	Africa	World
1	11%	0,5%	2%	2%	2%	75%	8%	100%
1000	10%	1%	2%	3%	4%	68%	12%	100%
1500	13%	1%	3%	4%	4%	65%	11%	100%
1700	13%	0,3%	3%	4%	2%	67%	10%	100%
1820	13%	1%	3%	5%	2%	68%	7%	100%
1940	13%	7%	4%	9%	6%	54%	8%	100%
2009	6%	5%	2%	4%	9%	59%	15%	100%

* Australia, New Zealand, USA and Canada

Source: Maddison, Historical Statistics of Maddison (2009); our elaboration.

Table 1.4.b. World population growth by region in the long run

Range in year	Western Europe	Eastern European	Western Offshoots*	Former USSR	Latin America	Asia	Africa	World
1 to 1000	2%	37%	67%	82%	104%	8%	90%	18%
1000 to 1500	124%	108%	50%	139%	54%	55%	44%	64%
1500 to 1700	42%	39%	-38%	57%	-31%	42%	31%	38%
1700 to 1820	63%	94%	542%	106%	79%	77%	22%	73%
1820 to 1940	121%	158%	1262%	258%	502%	74%	161%	121%
1940 to 2009	37%	28%	139%	45%	349%	224%	411%	194%
1 to 2009	1506%	2430%	32594%	7164%	10328%	2286%	5726%	2895%

* Australia, New Zealand, USA and Canada

Source: Maddison, Historical Statistics of Maddison (2009); our elaboration.

1.3. Urban Trends

To answer the questions already stated, we will analyze below four key elements that are part of the recent urbanization trends.

1.3.1. The distribution of World's Population

Although the remarkable population growth already reviewed, around 80% of the world's population is settled in cities which are at the bottom of the urban hierarchy -agglomerations with less than 1 million inhabitants- fact that indicates that an increase in the population could not necessarily be related to the phenomenon of urban concentration and high primacy rates.

Table 1.5. The distribution of world's population (2007)

Type of areas	Share of world's population
Rural areas	51%
Urban < 1 mill.	30%
Urban 1- 10 mill.	14%
Urban > 10 mill.	5%

Source: Population Reference Bureau (2007)

This distribution of human settlements generates some difficulties in the analysis of urban areas, because many dynamics of world's population cannot be well observed due to deficient data on rural areas and small agglomerations. This problem is usually resolved by cutting off the population below a certain level of agglomeration, with the counter effect that several observations get lost. For example, the usual cut off below 100,000 inhabitants drops about 40% of the world's urban population. An additional problem appears when we use different categories or ranges of population to organize cities by sizes. These issues are observed when we compare Table 1.5 and 1.6.

Table 1.6. Distribution of world's urban population (cut off: below 0,1 million) used by Henderson and Wang (2007)

Urban sizes		Share of urban population*
Small	0,1-1 mill.	37%
Medium	1-3 mill.	29%
Large	3-12 mill.	21%
Mega	> 12 mill.	10%

Source: Henderson and Wang (2007)
* This distribution caputures about 60% of world's urban population.

A second difficulty is linked to the availability of data for a sufficient period of time. For our research purposes, we use an urban population dataset similar to Henderson and Wang (2007), but we categorize cities sizes according the criteria of UN World Urbanization Prospects (Mega, Big, Midsize, Small and Towns) using data from 1960 to 2000. Additionally, to maintain the same set of observations between a 40 year period, we cutoff “new cities” of Town size that appear in the records after 1960. A better specification of our data will be presented later, when we review the urban structure using our “Urban dataset” which has about 1920 cities.

1.3.2. Urbanization Levels in World’s Regions

If we consider the most urbanized regions of the world in the year 1950, we will find basically Europe and North America; however, if we repeat the exercise for the year 2000 we find some important changes. Table 1.7 presents a detailed comparison between the levels of urbanism in different regions in a temporal frame of 60 years.

As a general pattern we can indicate that usually the levels of urbanization are notably superior among developed regions; even though this consideration cannot be considered as a rule. For example, Latin America goes in a different direction. In 2010, it reached a percentage of urban population that is similar to advanced economic regions, although its levels of income and quality of life corresponded to developing countries. The case of Western Asia is not different: in 2010 it presented similar levels of urbanism to those observed years before among advanced regions, such as Offshoots and Western Europe; however Asian countries had not reached the economic development that developed regions had at that time.

Moreover, the levels of economic development and urbanism are not similar among all world regions; the idea that all countries should follow the same path or stages of development is not clearly verified (Rostow, 1960). The variability of the relationship between urban levels and development levels depends on different institutional, geographical and historical characteristics.

Table 1.7. Percentage of urban population by region[4]

Area	1950	1980	2010*
Offshoots			
Northern America	63,90	73,93	82,13
Australia/New Zealand	76,16	85,35	**88,62**
Latin American			
South America	42,79	67,40	**83,98**
Central America	39,22	60,22	72,00
Europe			
Western Europe	63,83	72,71	**79,50**
Northern Europe	69,69	76,41	79,08
Southern Europe	45,13	62,15	67,77
Eastern Europe	39,72	63,81	68,94
Asia			
Eastern Asia	15,51	25,55	50,17
South-Central Asia	16,44	24,35	32,08
South-Eastern Asia	15,48	25,53	41,84
Western Asia	28,60	51,89	**66,53**
Africa			
Northern Africa	24,78	40,15	51,15
Eastern Africa	5,30	14,73	23,59
Western Africa	9,79	27,18	44,85
Middle Africa	14,00	28,96	43,12
Southern Africa	37,65	44,74	**58,69**

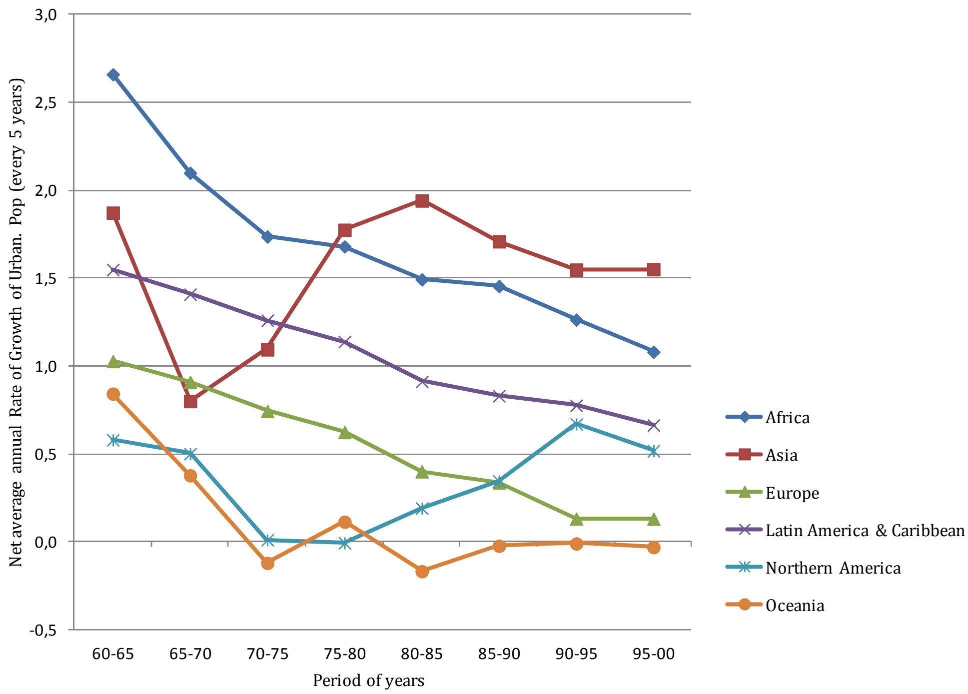
Source: UN World Urban Prospects (2009). * UN projections.

[4] **Northern Africa**: Algeria, Egypt, Libyan, Morocco, Sudan, Tunisia, Western Sahara. **Eastern Africa:** Burundi,Comoros,Djibouti,Eritrea,Ethiopia,Kenya,Madagascar,Malawi,Mauritius,Mozambique,Rwanda,Seychelles,Somalia,Uganda,Tanzania,Zambia,Zimbawe. **Middle Africa**: Angola, Cameroon, Central African Republic, Chad, Congo, Democratic Republic of the Congo, Equatorial Guinea, Gabon. **Southern Africa**: Botswana, Lesotho, Namibia, South Africa, Swaziland. **Western Africa**: Benin, Burkina Faso, Cape Verde, Côte d'Ivoire, Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Mauritania, Niger, Nigeria, Saint Helena, Senegal, Sierra Leone, Togo. **Eastern Asia**: China, Hong Kong SAR, Macao SAR, Dem. People's Republic of Korea, Japan, Mongolia, Republic of Korea. **South-Central Asia**: Afghanistan, Bangladesh, Bhutan, India, Iran, Kazakhstan, Kyrgyzstan, Maldives, Nepal, Pakistan, Sri Lanka, Tajikistan, Turkmenistan, Uzbekistan. **South-Eastern Asia**: Brunei Darussalam, Cambodia, Indonesia, Lao, Malaysia, Myanmar, Philippines, Singapore, Thailand, Timor-Leste, Vietnam. **Western Asia**: Armenia, Azerbaijan, Bahrain, Cyprus, Georgia, Iraq, Israel, Jordan, Kuwait, Lebanon, Palestina, Oman, Qatar, Saudi Arabia, Syrian Arab Republic, Turkey, United Arab Emirates, Yemen. **Eastern Europe**: Belarus, Bulgaria, Czech Republic, Hungary, Moldova, Poland, Romania, Russian Federation, Slovakia, Ukraine. **Northern Europe**: Denmark, Estonia, Faeroe Islands, Finland, Iceland, Ireland, Latvia, Lithuania, Norway, Sweden, United Kingdom. **Southern Europe**: Albania, Bosnia and Herzegovina, Croatia, Gibraltar, Greece, Italy, Malta, Montenegro, Portugal, Serbia, Slovenia, Spain, Macedonia. **Western Europe**: Austria, Belgium, France, Germany, Luxembourg, Netherlands, Switzerland. **Caribbean**: Anguilla, Antigua and Barbuda, Aruba, Bahamas, Barbados, British Virgin Islands, Cayman Islands, Cuba, Dominica Dominican Republic, Grenada, Guadeloupe, Haiti, Jamaica, Martinique, Netherlands Antilles, Puerto Rico, Trinidad and Tobago, Turks and Caicos Islands, Virgin Islands. **Central America**: Belize, Costa Rica, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama. **South America:** Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, French Guiana, Guyana, Paraguay, Peru, Suriname, Uruguay, Venezuela. **Northern America**:Bermuda, Canada, Greenland, United States of America **Oceania:** Australia, New Zealand, Australia, New Zealand.

1.3.3. Population and Urban Population Growth

The third element to review is the evolution of the growth rate of urban population. For this aim, it is necessary to isolate the effect of the population growth on the urban population growth. We consider the relation: $g_q = g_u - g_p$ [5], being g_q the rate of growth of urban population discounting rate of growth of population. Figure 1.3 and in more detail Table 1.8 show the results taking into account the average of annual growth rate of the population every five years from 1960 to 2000 in 6 regions of the world.

Figure 1.3. Average of the net rate of urban population growth by regions



Source: World Population Prospects (2009); our elaboration.

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[5] Given,

g_u : rate of growth of urban population

U_t : urban population at time t

P_t : country's population at time t

g_q : rate of growth of urban population discounting rate of growth of population

Then,

$g_u = (U_{t+1}/U_t)-1$

$g_u = (U_{t+1}/ P_{t+1}) * (P_{t+1}/ P_t) * (P_t/U_t)-1$; where $q_1 = (U_{t+1}/ P_{t+1})$

$g_u = q_1(1+g_p) * (1/q_0)-1$

$g_u = q_1/ q_0 (1+g_p)-1$

$g_u = ((q_0 + \Delta q)/ q_0)*(1+g_p)-1$

$g_u = (1+g_q)*(1+g_p)-1$

$g_u = g_q+g_p + (g_q*g_p)$; due the insignificant size of (g_q*g_p) it can be generalized that

$g_u = g_q+g_p$. As result we have: $\boldsymbol{g_q = g_u - g_p}$

If we compare the information about the level of urban population (Table 1.7) and the growth rate of urban population discounting population's growth (Table 1.8) we observe a sort of "convergence" process between the level of urban settlers and the urban growth rates, where regions with less urban population have a higher net growth rate of urban population that regions with higher urbanization rates; this phenomena works for developed or developing regions.

As an example, Europe has one of the highest levels of urbanism in the world and presents also one of the lowest urban growth rates. The same process is experimented in Latin America, which has decelerated its urban growth rates due to the high level of urbanism achieved. As outcome of this analysis, we expect that Asia and Africa will continue to lead the world's urban population growth because of their lower level of urban population.

Additionally, it is expected that higher urbanization increase congestion costs for workers and firms. Increasing demand of manufacturing goods, as well as transport and housing pushes prices up, affecting negatively urban wages and operation costs; consequently urban areas become less attractive for firms workers. This fact, as the World Development Report (2009:62) underlines, should contribute to reduce rural-urban disparities in well-being, because firms will tend to look for less costly location. In this sense, it is expected that a U-shape in the urban population growth. First, location economies attract rapidly firms and workers, then with increasing congestion costs, urban areas become less attractive and the urbanization process slowdown.

Another factor that can also affect urban growth rates is the improvement in transport technologies and transport infrastructure, elements that facilitate rural-urban commuting, reducing the need to move towards urban areas.

Finally, it is important to remark that levels of urbanism and their growth rates vary according urban space particularities, because of different geographic, economic and institutional elements that influence the economies and diseconomies of agglomeration.

Table 1.8. Average rates of population change every five years by world's regions (1960-2000)

Average Annual Growth Rate of Population (percentage): g_p

	60-65	65-70	70-75	75-80	80-85	85-90	90-95	95-00
World	1,85	2,07	1,96	1,77	1,76	1,74	1,52	1,34
Africa	2,44	2,56	2,65	2,77	2,80	2,69	2,53	2,36
Asia	1,99	2,48	2,28	1,95	1,94	1,92	1,63	1,38
Europe	0,96	0,69	0,61	0,49	0,40	0,38	0,19	-0,02
Latin America & Caribbean	2,76	2,51	2,41	2,29	2,10	1,92	1,71	1,55
Northern America	1,41	1,07	0,94	0,97	0,97	1,03	1,01	1,15
Oceania	2,06	2,19	1,94	1,33	1,61	1,60	1,48	1,39

Average Annual Growth Rate of Urban Population (percentage): g_u

	60-65	65-70	70-75	75-80	80-85	85-90	90-95	95-00
World	3,08	2,67	2,56	2,67	2,70	2,63	2,38	2,22
Africa	5,10	4,66	4,39	4,45	4,29	4,15	3,79	3,44
Asia	3,86	3,28	3,38	3,72	3,88	3,63	3,17	2,93
Europe	1,99	1,60	1,35	1,11	0,80	0,72	0,32	0,11
Latin America & Caribbean	4,31	3,92	3,67	3,43	3,01	2,75	2,49	2,21
Northern America	1,99	1,57	0,95	0,97	1,16	1,37	1,68	1,67
Oceania	2,91	2,56	1,82	1,45	1,44	1,58	1,47	1,36

Average Differential Growth Rate of Urban Population (percentage): g_q*

	60-65	65-70	70-75	75-80	80-85	85-90	90-95	95-00
World	1,23	0,60	0,60	0,90	0,93	0,89	0,86	0,88
Africa	2,66	2,10	1,74	1,68	1,49	1,45	1,26	1,08
Asia	1,87	0,80	1,09	1,77	1,94	1,71	1,55	1,55
Europe	1,03	0,91	0,74	0,62	0,40	0,34	0,13	0,13
Latin America & Caribbean	1,55	1,41	1,26	1,14	0,91	0,83	0,78	0,66
Northern America	0,58	0,50	0,01	-0,01	0,19	0,35	0,67	0,52
Oceania	0,84	0,38	-0,12	0,11	-0,17	-0,02	-0,01	-0,03

*$g_q = g_u - g_p$

Source: UN Urban Population Prospects (2009); our elaboration.

1.3.4. Urban Structure and Economic Development: A First Approximation

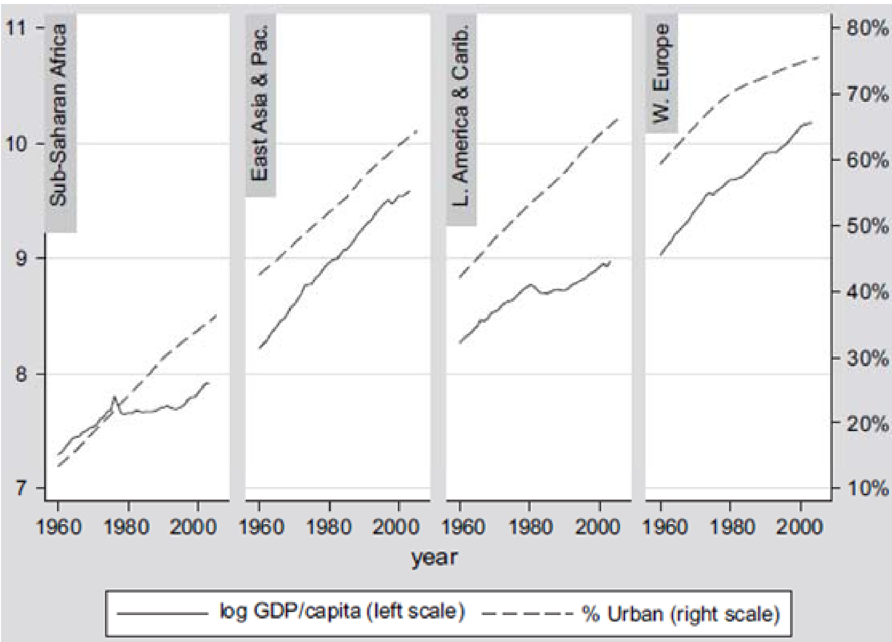
Since the beginning of civilization, as Bairoch (1988) indicates, the urban phenomenon and development have been associated; however the links are complex.

Wheaton and Shishido (1981) following the market areas theory developed by German Industrial Location School (Von Thünen, 1826; Christaller, 1933; Lösch 1954), indicate that:

> "…in any country, the actual distribution of urban settlements follows from efficient or optimal economic behavior. In the long run, therefore, the pattern of cities which emerges should represent an optimal equilibrium (…). It is hypothesized that the number of production locations (urban settlements) emerges in a manner which minimizes the combination of unit production costs and buyer transportation costs. A large number of production centers allows dispersal, and hence a savings in transportation or access costs". (Wheaton and Shishido, 1981:21).

The emergence of such optimal urban setting is expected, according Arthur (1988), if we do not take into account "historical accidents", that is the presence of other elements, beyond the economic rationality, that affect the emergence of an urban system. Therefore the urban setting does not always mirror an efficient economic structure. Indeed, high urbanization rates do not necessarily imply, neither a deep transformation of the economic structure nor the achievement of high income levels as is observed in the Figure 1.6 where clearly Sub-Saharan Africa and Latin America do not show a correlation between the levels of urban population and income.

Figure 1.4. GDP per Capita and Urbanization rate (1960-2000)



Source: van der Ploeg and Poelhekke, 2008

In view of these facts, we can identify two types of urbanization processes: performing urbanism and non-performing urbanism.

Performing urbanism indicates a particular arrangement of the urban structure that emulates in some extent the idea of Christaller (1933) in which the urban setting due to institutional aspects (administrative principle), economies of scales (market principle), and transport costs (transport principle), shape an optimal hierarchical city system. As a result of this efficient setting it is expected that urban structure also give support to economic development. To develop his theory, Christaller made some basic assumptions: presence of isotropic land (without roughness and weather changes); even distribution of population and resources; similar purchasing power and proportional transport cost according travel distances. He also considered that industries would be located in central places to grasp the benefits economies of scale, while consumers will commute to closer areas where it's possible to achieve more goods and services.

As result he visualized a central place city that will supply goods and services to the cities that are located in its shadow (area of influence), where each city has its own circular market area which is proportional to the level of goods and services that the city supplies, resulting in a balanced city system.

However, which would be the result if some assumptions of the model are different? It means, the presence of non isotropic land; population and resources that are not homogeneously dispersed due to historical and geographic accidents; transport cost that are not proportional to distance due to quality of infrastructure and roughness and finally, the effect of an element that Christaller did not consider: the presence of a dysfunctional administration mainly concentrated in capital cities and consequent insecurity around rural settlements.

In this scenario it is feasible to think that the urbanization process will not necessarily be linked to economic efficiency. Weak democracy, concentration of power and insecurity will deeply affect the urban structure. As consequence, it will be observed an increasing agglomeration in the main city because of the necessity to interact with the center of power and to avoid insecure hinterlands. In this process the agglomeration in the main city will rapidly raise; hence firms will be attracted by the increasing market size, impelling even more, the city size in spite of the presence of greater diseconomies of agglomeration.

In this context, a giant agglomeration will emerge where strong negative pecuniary externalities (i.e. increasing cost of housing and commuting) arise, as well as negative technological externalities (i.e. pollution), while positive technological externalities (i.e. spillovers) become weak, due to the presence of several industries with few mutual technological complementarities. Moreover, positive economic externalities (i.e. scale economies) cannot be well deployed due to increasing wages and transport costs. In this case the reasons behind urban growth are mainly driven by non-economic factors.

This is what we call *non-performing urbanism* where positive pecuniary externalities and positive technological externalities of urbanization are not catalyzed into economic prosperity.

In this scenario, it is feasible to think that the main city will absorb population of cities of lower size because of the presence of concentrated administrative power and larger market size. As consequence, a "polarized" urban structure emerge, which means the presence of "pure" large urban centers that contrast with "pure" disseminated rural areas, without a strong intermediate city network which does not offer a sustainable link between the urban an rural world. Thus, the gap between the rural and urban "world" is enlarged; real wage differential increase notably and Hoselitz's "hyper-urbanization" takes place, where rural-urban migration grows at a higher rate than urban formal employment.

Additionally, massive rural-urban migration increases cost of living affecting the expected real wage differentials and the probability to get a job in the city. As corollary, new settlers are forced to reduce their cost of transport and housing, and to get a "job" in the informal economy. For these reason poor will tend to locate in urban areas with low cost of housing, becoming this, a key element in the city growth equation (Helpman, 1995), and/or in places with low commuting cost (Glaeser *et. al.*, 2000). In this context of non-performing urbanism, slums will spring up.

As Harris and Todaro (1970) remark, rural-urban migration occurs because of both, the rural-urban wage differentials and the probability to get a job in the urban area (expected wage differentials), which is at the same time, a function of urban unemployment. Consequently, a mismatch between expectations and wage differentials arise, fact that becomes stronger in polarized urban structures. In this context the phenomenon of informality will be amplified.

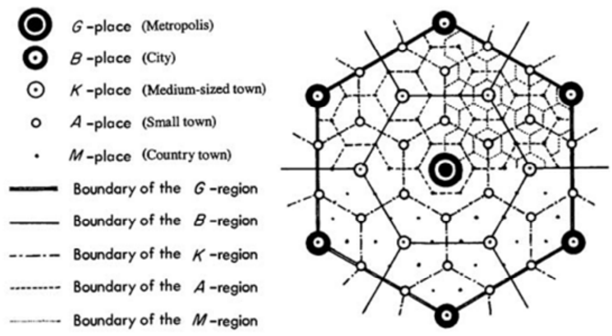
1.4. The Urban Structure: Elements and evolution

Von Thünen (1826) with the "isolated state" model, was the first one in propose a theory of general equilibrium in space (Samuelson, 1983; Fujita, 2010) pointing out that an efficient urban landscape is shaped by economic forces, where transport cost, cost of land and crop productivity interact simultaneously.

Under a similar perspective, but in a broader scale, Christaller (1933) considered that the urban structure is shaped by transport costs, economies of scale and institutional elements. The interaction of these three pillars, produce a diversified grid of cities where the coexistence of inferior order cities with superior ones is feasible. It means that the centripetal forces exerted by a main agglomeration are not able to absorb the inferior orders cities, like in "black hole cities" (Short,2008[6]), due to the equilibrium of a strong city network.

In Christaller's structure (see Figure 1.5), large agglomerations and small ones are linked through a middle city network, which becomes fundamental for an integrated an optimal urban structure. These type of agglomerations seem to work like "pivot cities" between superior and inferior orders, giving mobility and consistency to the urban grid. Middle cities provide industrial specialization (Henderson 1974, 1997) to the urban structure; also through the reduction of diseconomies of agglomeration of superior order cities, especially when these host industries with few technological externalities. Additionally, middle cities push out small cities from their institutional, economic and transport isolation. Certainly for this type of city interconnection, transport infrastructure and good quality educational and health services are essential to work properly.

Figure 1.5. Optimal urban structure according Christaller



Source: Christaller, 1933

Since then, different conceptualizations of the urban structure had aroused. Hodge (1968) defines the urban structure as a set of independent social, economic and physical dimensions of a spatial unit. Horton and Reynolds (1971) indicate that the typical conception of urban spatial structure includes linear features, such as transportation networks, commercial ribbons, manufacturing nodes, residential populations and densities, as a general description of the distribution of the urban space. Anas *et. al* (1998) describe urban structure as the degree of spatial concentration of urban population and employment where centralized and decentralized urban landscapes can be distinguished. Lee and Gordon (2007) consider the urban structure in terms of employment shares in three types of metro areas: central business district, sub centers and dispersed locations. Rossi-Hansberg and Wright (2007) consider the urban structure as the number and size of cities in a country.

[6] According Short (2008), "black hole cities" are characterized as being very large cities, which present a size comparable to "global cities" or "global-cities regions" but are not globalized (less connected cities), becoming "black holes" which destroy the urban structure. Among these cities are Dhaka, Kinshasa, Lahore, Khartoum, etc.

To capture the urban structure, literature and empirical studies use different perspectives which we can be organized in the following way:

- Demographic perspective of urban structure
- Geo-economic perspective of urban structure
- Political perspective of urban structure
- Historical perspective of urban structure
- Morphological perspective of urban structure

The separation between these five perspectives is useful to identify the diverse elements of the urban structure; nevertheless the separation line between these is not always clear.

The *demographic perspective of urban structure* seeks to capture the characteristics of a delimitated space through demographic indicators such as urbanization level (urban and non urban population), the level of primacy (population of the principal city over the total urban population); the number and category of cities according to population size; the urban density. The use of this perspective has been spread out due to data availability. It stands out the study of Anas et.al (1998).

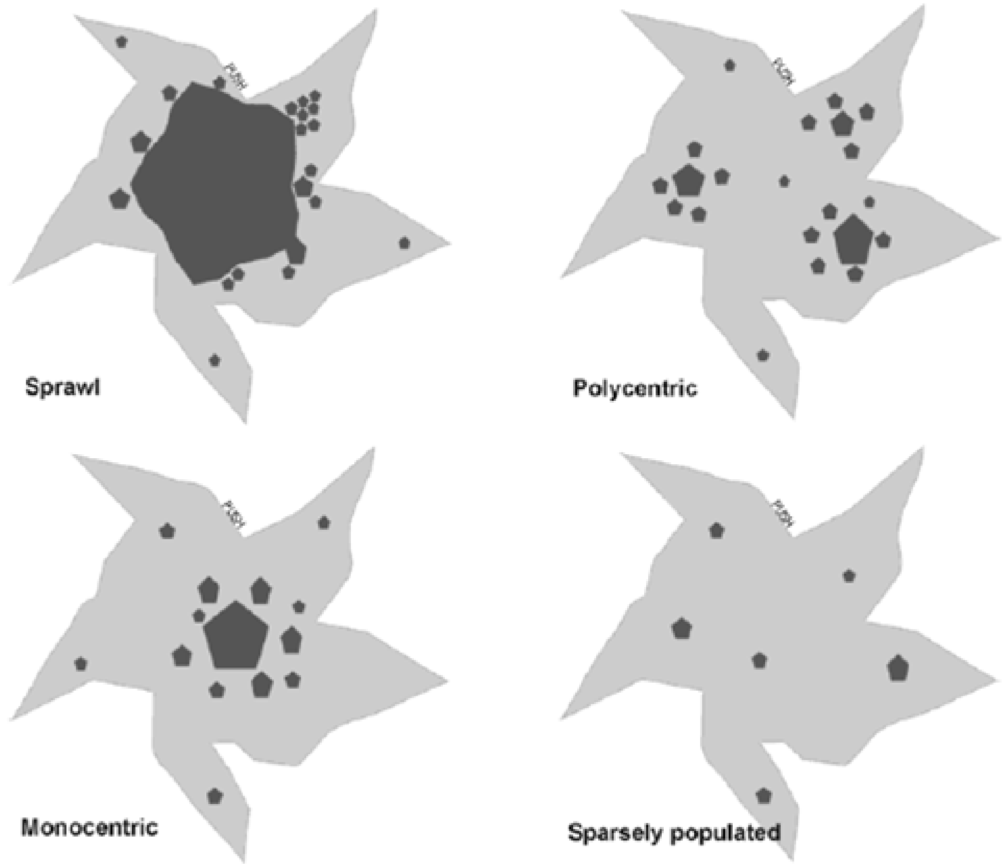
The *geo-economic perspective of urban structure* uses economic and geographical indicators and the integration of both (geo-economic indicators) to capture the characteristics of an urban space; it considers also demographic elements. Some of the indicators used are: the level of hierarchy of a urban system (Zipf's parameter), the geographical endowment (availability of arable lands, shipment possibilities, etc); the spatial distribution of employment according to sectors (agriculture, manufacture), the role of trade, the influence of geographical distance and costs of transport, etc. The main contributions to this perspective come from the Economic Geography and New Economic Geography where Von Thünen (1826), Christaller (1933) and Lösch (1954) and Fujita (1989), Krugman (1991) stand out. Under this perspective the urban structure is an urban system (or a collection of cities; Henderson, 1974; Fujita *et. al.* 1999), where the interaction and interdependence between a certain set of cities which have different functions and specializations is observed.

The *political perspective of urban structure* captures the spatial distribution of power through indicators such as the level of fiscal or political federalism; likewise it considers the effect of democracy level on agglomeration or the political orientation on trade and its effect on agglomeration. Important contributions have been done by Krugman and Livas (1992), Henderson and Wang (2007) .

The *historical perspective to the urban structure* considers the effect of historical aspects in the generation of a particular urban structure. This perspective affirms that the urban structure is process-dependent (Arthur, 1988) emerging from stratified historical and institutional processes or, as Krugman (1991b) points out, it is the result of elements of first and second nature. Main empirical studies on urban agglomerations integrate the diverse perspectives indicated above; some relevant contributions are done by Ades and Glaeser (1995), Davis and Henderson (2003).

The morphological perspective to the urban structure defines four types of urban structure considering the morphological point of view: (1) Sprawl is characterized by “continuous settlements without particular grouping”, (2) Monocentric by a “grouped settlement dominated by a large settlement area with no secondary groupings”; (3) Sparsely populated regards “few relatively small settlements scattered separated by long distances” and (4) Policentric urban structures are “characterized by several larger groups of settlements, which are clearly distinct from each other and spread out across the considered area” (ESPON, 2004:152).

Figure 1.6.Types of urban structure according ESPON



Source: European Spatial Planning Observation Network, Report 1.1.1., 2004:152

1.4.1. The Definition and Categories of Cities

A detailed analysis of the urban structure and its transformation requires the identification of the unit of analysis: the city. However, its definition carries out several problems due to the different scopes and approaches involved in understanding its complexities.

In this sense, we consider two main questions: what a city is? why cities exist? The first question indicates a *descriptive and definitional* concern; the second question regards its *nature and evolution*, demanding the consideration of historical and other elements involved in its foundation. We analyze below the first question due to the descriptive purposes of this chapter, leaving to the next chapter the analysis of why cities exist.

When size matters: Defining our unit of analysis

Our research intents to understand different patterns of cities' growth in the world; however several problems arise in this effort. The first and perhaps most important problem is to deal with different definitions and measures of the city, because treating all the cities as similar entities, carries out serious risks of oversimplification.

The first problem regards terminology; definitions of urban localities vary between and within countries (United Nation, 1974); fact that makes difficult to assess what a city is, at least for statistical purposes. The online Glossary of Statistical Terms of the OECD (http://stats.oecd.org/glossary/) does not present the word "city"; we can find definitions of "city groups" or "administrative regions" but not what a city is. In a recent publication of OECD (2010) the definition of city considers the three classic criteria:

Administrative definition: Considers administrative and legal boundaries. This definition is based on the territorial organization for governmental and judiciary aims. Each country presents its own administrative unities (or city proper)[7], and being this criteria politically shaped, it is usual to observe different definitions of the urban units in each country, fact that makes very difficult any comparison. Consequently, this definition and its statistical information, usually does not capture the complex evolution of urban settlements, the life within the city and its true size, representing the less appropriate criterion to describe what a city is.

[7] According the UN definition (see Glossary of UN World Urbanization Prospects 2007 available at: http://esa.un.org/unup/index.asp?panel=6) the city proper is a "a locality defined according to legal/political boundaries and an administratively recognized urban status that is usually characterized by some form of local government."

Physical definition: Considers the city according its physical form using different indicators to define it (i.e. densities of people, housing, manufactures, transportation networks, etc.). The most typical example of a physical definition is the concept of "agglomeration". This French rooted definition has influenced the international classification, in part due to its simplicity. According to the *Institut national de la statistique et des études économiques* (Insee), an agglomeration is defined as an urban form that can be composed by a group of municipalities sharing the continuum of a built area (no break of more than 200 meters between two buildings)[8]. Following this concept, the United Nations defines the urban agglomeration as "*de facto* population contained within the contours of a contiguous territory inhabited at urban density levels without regard to administrative boundaries. It usually incorporates the population in a city or town plus that in the sub-urban areas lying outside of but being adjacent to the city boundaries." [9]

Data availability is certainly an advantage of the physical criterion; data on agglomerations is available for several countries and for large periods of time.

However, this perspective is also limited for comparative purposes due to institutional and geographical differences that are not taken into consideration:

> "There are problems when it comes to international comparisons because of differing patterns between countries in settlement patterns - sometimes reflecting institutional differences and sometimes historical or topographical ones. Moreover the trade-off between simplicity for gathering data and accuracy for capturing urban reality may err too far on the side of simplicity." (OECD, 2010:10)

Furthermore, this physical definition is not able to capture well the contained citizen's life (work, education, health, cultural and commercial activities) which in the recent years has expanded. With increasing mobility, within and between built-up areas, it has become more difficult to measure the real boundaries of cities.

This fact is particularly present in advanced economies which enjoy well established transport infrastructure and strong land regulations that shape the urban landscape. Usually advanced urban systems are sparse and strongly interlinked creating large urban spaces that overcome regions and nations. Conurbations, megalopolis, industrial and green belts are transforming the landscapes where continuous urban corridors make difficult to observe the boundaries of cities.

Moreover, if we consider the effects of land regulations on land markets and on the expansion of cities - see for instance the contributions of Cheshire and Sheppard

[8] See www. http://www.insee.fr/fr/methodes/
[9] See Glossary of UN World Urbanization Prospects at: http://esa.un.org/unup/index.asp?panel=6.

(2004), Bertaud and Brueckner (2005) – the built-up perspective remains incomplete to indicate the sphere of the city.

To assess these potential differences between built-up areas in different world's regions, Huang *et. al.* (2007) analyze different urban forms in Asia, US, Europe and Latin America, on the basis of spatial metrics and remote sensing. They consider the definition of city as the built-up area or urbanized land indicated in the images under analysis. They observe that, as a general pattern, cities in developing regions are more compact and dense than those in developed ones. These differences can be explained by elements that are more present in developed urban systems, such as land regulations, better transport technologies and diffused educational and health services, among others.

Functional definition: During the industrial filtering-down process, industries moved from metropolitan to non-metropolitan areas, pushed mainly by increasing wages, land prices in cities and by the reduction of transport cost (see Erickson 1976). This filtering-down phenomenon affects the configuration of cities, demanding strong regulations of land usage and the development of better transport infrastructures, elements that also contribute to the development of suburbanization (Mieszkowski and Mills, 1993).

However, the expansion of commuting patterns and the evolution of the economic structures towards a more knowledge and interacting economic activities (see Comunian, 2011) have reinforced (again) the role of the cities, that have become centers of creativity. Therefore, we observe a return to the city but under new mobilization patterns, where different types of networks interact simultaneously, shaping particular urban spaces within and between cities.

This evolution of the urban space, demands better criteria to identify real cities sizes, because the physical criterion becomes unsuitable to capture the real urban dimension.

An initial attempt to measure in a different way the size of cities, was the US concept of Metropolitan Statistical Area (MSA). In this perspective, the city was defined not only through population densities, but also through the analysis of job related commuting patterns, capturing in a better way the basic constituting elements of the city; hence not only looking its form but also its function.

In the European contexts, Cheshire and Hay (1989) pointed out that Functional Urban Regions (FUR) represent a more suitable definition to describe the city:

> "FURs are functional in that their boundaries are determined on the basis of economic relationships rather than history or political divisions. They attempt to capture the economic sphere of influence of a city with a core city denied in terms of concentration of employment and a commuting hinterland composed of all those

areas from which people commute to the particular city in question than to some other city" (Cheshire and Hay, 1989:15).

This approach has spread out in the European context (see for instance ESPON 1.1.1., 2005) representing an important step forward. Several countries have adopted this conceptualization, although methods vary between them (see Antikainen, 2005). A limit in using this approach for comparative purposes is data scarcity, especially among developing areas.

Our (limited) selection

As corollary of the previous considerations, the type of definition of city will affect the empirical analysis and the conclusion that can be withdrawn. Considering the three definitions of cities reviewed, we easily drop the administrative definition, due to the difficulties of comparison and its limits to capture real city sizes. Then, we remain with two possibilities: physical definitions -which presents the risk to oversimplify the real dimension of cities- and functional definitions, which appear to be the most appropriate description of our unity of analysis. Nevertheless, the selection of a functional criterion, due to data scarcity, could lead to abandon the possibility of observing growth patterns in developing countries, which account for the most important urban changes in the last decades.

As we said, Huang *et. al.* (2007) observe compact and non-compact urban forms according their location in developed or developing countries. Under this consideration, it is reasonable to think that the large and dense agglomerations in developing countries tend to self-contain all the urban functions, presenting a weak relational net with other urban centers; the reverse can be for more sparse functions in developed countries, where agglomeration definitions perhaps does not capture the whole function that define an urban form.

Consequently, in our analysis of the determinants of urban growth, we will consider urban agglomeration data (UN definition), although we understand the limits that can have our conclusions, especially if we compare different economic and institutional contexts.

An additional justification of this (simplifying) selection is due to our interest in considering the urban structure in our analysis. Most data used for capturing urban structures, mainly in the form of the Zipf's parameter, are calculated on urban agglomerations data (see for example Soo, 2005).

Moreover, for our city sizes analysis we also consider a cities' categories according a range of population; thus we will use the definition of the UN World Urbanization Prospects which divides the size of cities in five categories: Mega cities with more than 10 millon habitants, Big cities between 5 and 10 millions, Midsize cities between 1,5-5 millions, Small cities between 0,5 to 1,5 millions and Towns with less than 0,5 millions.

To analyze the evolution of the number and size of cities between the years 1960 and 2000 we will use our Urban dataset (see Appendix 1.1) which considers 1919[10] cities located in 134 countries, involving more than 55 %[11] of the world's urban population. For more details about the coverage of our dataset see Table 1.9.

Table 1.9. Coverage of the Urban Dataset of the world's urban population

Urban Population	1960	2000
World Urban Population (millions)	998	2837
Covered by Urban Dataset (millions)	638	1585
Share of coverage	64%	56%

Source: UN World Population Prospects (2009) and Urban dataset

In Table 1.10 we observe the urban structure distributed in different city sizes, considering their number, their average population and their share on urban population according the Urban dataset.

During a period of 40 years the urban structure has known a substantial transformation. The share of Big and Middle cities of the urban population has notably increased; meanwhile the share of Small cities and Towns has declined. These changes need a detailed analysis.

Table 1.10. Cities sizes and urban population distribution 1960 and 2000

City size (millions)		Number of cities 1960	Average pop. per city 1960	Share* 1960	Number of cities 2000	Average pop. per city 2000	Share* 2000
Mega	> 10	2	12.600.000	4%	19	13.821.053	16,6%
Big	5 - 10	12	6.706.417	12,6%	23	7.064.609	10,3%
Midsize	1,5 - 5	56	2.431.383	21,3%	188	2.503.472	29,7%
Small	0,5 - 1,5	205	815.576	26,2%	440	910.897	25,3%
Town	< 0,5	1649	138.813	35,9%	1254	230.078	18,2%
		1924		100%	1924		100%

By group of city sizes		Number of cities 1960	Share* 1960	Number of cities 2000	Share* 2000
Mega+Big	>5 mill	14	16,60%	42	26,80%
Midsize	1,5-5 mill	56	21,30%	188	29,70%
Small+Town	<1,5mill	1854	62,10%	1694	43,50%
		1924	100%	1924	100%

Source: Urban dataset, own elaboration.

* Share of the urban population of the Urban dataset (total 1924 cities)

[10] For some elaborations, such as the distribution of city sizes we used a distribution of 1924 cities, nonetheless for the regression we used 1919 cities, because for the regression we excluded some overseas territories i.e. Reunion island and French Polynesia, among others.

[11] The difference between the share of coverage of the urban dataset between 1960 and 2000 is due to the emergence of "new cities" by the year 2000, much of these records correspond to China.

1.4.2. Growth and Jumps among Cities Sizes

Which are the different rates of growth of city population in each category between 1960 and 2000? To answer this simple question, it is necessary to observe the processes of urban transformation by each category, where it is possible to identify three types of transformations: (1) cities that in the period analyzed remained in the same category; (2) cities entering in a new category and (3) cities that went out from a category.

For this analysis we have applied the following definitions of variables which allow us to identify accurately, the average city sizes by each category and its evolution in time.

Definition of variables:

P_0 city population at the year 1960

P_1 city population at the year 2000

k category of cities, where k goes from 1 to 5 according their size; (1= Mega cities sizes; 2 =Big; 3 =Midsize; 4 = Small and 5 = Town)

n number of cities

nk_0 number of cities in the k^{th} category 1960

nk_1 number of cities in the k^{th} category in 2000

where: $\sum_{k=1}^{5} nk_0 = \sum_{k=1}^{5} nk_1 = n$

$SAMEk$ Cities that in 1960 and 2000 remained in the same k^{th} category

INk_1 Cities that entered in the k^{th} category in 2000

$OUTk_1$ Cities that got out of the k^{th} category in 2000

$P_0(nk_0)$ Pop. in 1960 of all cities of category k in 1960

$P_1(nk_1)$ Pop. in 2000 of all cities of category k in 2000

$P_0(INk_1)$ Pop. in 1960 of cities that in the year 2000 had entered in the k^{th} category

$P_1(INk_1)$ Pop. in 2000 of cities that in the year 2000 had entered in the k^{th} category

$P_0(OUTk_1)$ Pop. in 1960 of cities that in year 2000 got out of the k^{th} category k in 2000

$P_1(OUTk_1)$ Pop. in 2000 of cities that got out of the k^{th} category in 2000

$P_0(SAMEk)$ Pop. in 1960 of cities that remain in the same k^{th} category in 2000

$P_1(SAMEk)$ Pop. in 2000 of cities that remain in the same k^{th} category in 2000

Table 1.11. Changes in cities sizes and cities population between 1960-2000

Number of cities in k^{th} category 1960

	1	2	3	4	5	Total 60'
1	2	-	-	-	-	2
2		12	-	-	-	12
3			56	-	-	56
4				205	-	205
5					1649	1649
						1924

Number of cities in k^{th} category 2000

	1	2	3	4	5	Total 00'
1	19	-	-	-	-	19
2		23	-	-	-	23
3			188	-	-	188
4				440	-	440
5					1254	1254
						1924

Transition matrix 1960-2000; number of cities

	1	2	3	4	5	
1	2	-	-	-	-	
2	7	5	-	-	-	
3	8	13	35	-	-	
4	2	4	90	105	4	
5	-	1	63	335	1250	
Total 00' (nk_1)	19	23	188	440	1254	1924

Population in cities of the k^{th} category 1960 (mill.)

	1	2	3	4	5	Total 60'
1	25	-	-	-	-	25
2		80	-	-	-	80
3			136	-	-	136
4				167	-	167
5					229	229
						638

Population in cities of the k^{th} category 2000 (mill.)

	1	2	3	4	5	Total 00'
1	263	-	-	-	-	263
2		162	-	-	-	162
3			471	-	-	471
4				401	-	401
5					289	289
						1585

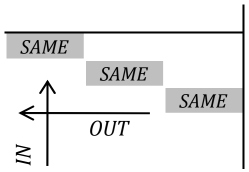
Transition matrix 1960-2000 ; population (mill.)

	1	2	3	4	5	
1	43	-	-	-	-	
2	91	40	-	-	-	
3	103	93	112	-	-	
4	26	25	228	116	2	
5	-	5	131	285	287	
Total 00' (P1)	263	162	471	401	289	1585

Rate of growth of cities' population per group of cities, 1960-2000

	1	2	3	4	5	
1	71%	-	-	-	-	
2	101%	15%	-	-	-	
3	287%	220%	39%	-	-	
4	1660%	396%	185%	49%	-34%	
5	-	1023%	612%	259%	119%	
Total 60'-00'						148%

Legend
1= Mega cities
2= Big cities
3= Midsize cities
4= Small cities
5= Towns



Source: Urban dataset, our elaboration.

Note: Data 5 cities from French Polynesia, Reunion, Namibia and Serbia, we later we dropped due to problems of data availabiltiy.

After observing Table 1.11 (see above transition matrix in number of cities), the first element to underline is the great number of city changes at the lower levels of the urban hierarchy (sizes 4 and 5 or Small and Towns). This fact shows a migration pattern which goes from the periphery to the center; hence most of the changes appear in the "first urban frontier" (Towns[12]). Then the number of city changes slows down until the summit of the urban hierarchy (Mega cities).

Observing the transition matrix of cities' population we find a great increase in two groups Mega cities and Midsize cities. In the period analyzed about 220 millions of new inhabitants entered in Mega cities, which is more than half of the current Western Europe's population. Likewise, Midsize cities received about 360 millions of new settlers.

The last matrix gives interesting information on the specific rate of population growth in each category. As it's expected, the highest rates of population growth are among those cities that "jumped" two or more categories. Those are cities that passed from category 4 to category 1 or from 5 to 2. These jumps are what we call "traumatic jumps" due to their extremely high urban growth.

Another element to underline is the high rate of population growth among Mega cities that remain in the same category (71%), showing that although their important size, this type of cities continue to grow.

To deepen our analysis, we present the following tables (from Table 1.12 to Table 1.15), which offer a detailed analysis of the urban transformation, showing the changes in the average cities' sizes, as well as, the average rates of growth in each category.

[12] It is important to mention that in the group of Towns (category 5) observations are not representative for all world's Towns, because the group has been cut off as explained before.

Table 1.12. Changes is the number of cities by category (1960-2000)

k^{th} Category	*n(SAMEk)*	*n(INk)*	*n(OUTk)*	*nk* 0	*nk* 1
1	2	17	0	2	19
2	5	18	7	12	23
3	35	153	21	56	188
4	105	335	100	205	440
5	1250	4	399	1649	1254
Total	1397	527	527	1924	1924

Table 1.13. Average size of cities per group in 1960[13]

k^{th} Category	$P_0(SAMEk)$	$P_0(INk_1)$	$P_0(OUTk_1)$	$P_0(nk_1)/nk_1 = \alpha_0 k$
1	12.600.000	4.323.294	0	5.194.526
2	6.982.400	1.907.778	6.509.286	3.010.957
3	2.308.012	643.088	2.637.000	953.047
4	743.172	236.567	891.599	357.462
5	104.640	681.748	245.874	106.481
Totale	250.340	546.879	546.879	331.565

Table 1.14. Average size of cities per group in 2000[14]

k^{th} Category	$P_1(SAMEk)$	$P_1(INk_1)$	$P_1(OUTk_1)$	$P_1(nk_1)/nk_1 = \alpha_1 k$
1	21.500.000	12.917.647	0	13.821.053
2	8.015.400	6.800.500	13.057.143	7.064.609
3	3.197.685	2.344.665	9.291.143	2.503.472
4	1.107.112	849.397	2.799.348	910.897
5	229.380	448.333	1.054.224	230.078
Totale	428.037	1.873.025	1.873.025	823.832

13
$$\alpha_0 k = \frac{P_0(nk_1)}{nk_1} = \frac{P_0(nk_0) + P_0(INk_1) - P_0(OUTk_1)}{nk_0 + n(INk_1) - n(OUTk_1)} = \frac{P_0(SAMEk_0) + P_0(INk_1)}{n(SAMEk_0) + n(INk_1)}$$

14
$$\alpha_1 k = \frac{P_1(nk_1)}{nk_1} = \frac{P_1(nk_0) + P_1(INk_1) - P_1(OUTk_1)}{nk_0 + nINk_1 - nOUTk_1} = \frac{P_1(SAMEk_0) + P_1(INk_1)}{n(SAMEk_0) + n(INk_1)}$$

Table 1.15. Average rates of growth among cities of the k^{th} category (1960-2000)

	(I)	(II)	(III)	(IV)	(V)
k^{th} Categories	**Rate of growth of cities that remain in the same kth category**	**Rate of growth of cities that entered in the kth category**	**Rate of growth of cities that got out of the kth category**	**Rate of growth of cities that in 1960 belonged to the kth category**	**Rate of growth of cities that in 2000 belonged to the kth category**
	$(P_1(SAMEk_0)-P_0(SAMEk_0))/P_0(SAMEk_0)$	$(P_1(INk1) - P_0(INk_1))/P_0(INk1)$	$(P_1(OUTk_1) - P_0(OUTk_1))/P_0(OUTk_1)$	$((P_1(SAMEk_0)+P_1(OUTk_1))/(P_0(SAMEk_0)+(P_1(OUTk_1))$ $(P_1(nk_0)/P_0(nk_0)$-1	$((P_1(SAMEk_0)+P_1(INk_1))/(P_0(SAMEk_0)+(P_1(INk_1))$ $(\alpha_{1}k/\alpha_{0}k)$-1
1	71%	199%	0%	71%	166%
2	15%	256%	101%	63%	135%
3	39%	265%	252%	125%	163%
4	49%	259%	214%	137%	155%
5	119%	-34%	329%	209%	116%

The *SAMEk group* (column I), presents in the lowest hierarchy (category 5) the highest average rate of growth among all the categories of cities. However, this column does not show a clear relationship between the size of cities and their rate of growth.

The *INk* group (column II), as we expected, is the most dynamic one. The rate of growth from category 1 to category 4 is around 200% or more. It's interesting to notice an intense activity around Midsize cities. As example, in Table 1.11 the rate of population growth of cities that jumped from category 5 to 3 is 612% and from category 3 to 4, 185%. Additionally, cities that exit category 3 to go to category 2 grew 220% (3 to 2) and cities that exit category 3 to go to category 1 grew 287%. In synthesis, 153 cities became Midsize, while 21 cities went to upper levels.

This mobility around the Midsize group is also observed in (column III) which presents average rates of growth among cities that got out of each category. In this column, we verify an important rate of growth of cities that got out of the Town size towards Small sizes.

Column IV indicates the average rate of population growth among cities that in 1960 belonged to the k^{th} category. The rates of growth capture the dynamic of "*SAME*"(column I) and "*OUT*" (column III) groups, for each category of city. We observe a relationship between the city size and their rate of growth. Smaller cities grow faster, while larger cities present lower rates of growth. These rates of growth are coherent with the idea of urban convergence. Larger cities present increasing congestion costs which slowdown their rates of growth.

Column V presents the rate of growth of cities that in 2000 belonged to the k^{th} category, which is the average growth of "*SAME*"(column I) and "*IN*" (column II) groups, for each category of city. In this case, we do not observe a convergence path. Mega cities present the highest average rate of growth (166%), followed by Midsize cities (163%), Small cities(155%) and Big cities (135%).

From this analysis, we get interesting hints. By one side, we have observed a sort of urban convergence process, where the group of small size grows faster; and when the city size increases, the rate of population growth slowdown. This is coherent with the urban economic literature where increasing sizes impel congestion costs. On the other side, we also observe that this cannot be taken as a rule. In average we observe that Mega cities and Midsize present higher rates of growth, hence the growth patterns are not necessarily related to their size, confirming in some extend the Gibrat's law (1931), which states that growth of cities is independent to their size. In this sense, our analysis makes more evident the open debate regarding the Gibrat's law[15].

To improve the understanding of city sizes growth it's important to consider the development level of the countries to which they belong. As a matter of fact, Mega cities, Big cities and most of Midsizes cities which are in the SAME category (the most stable group), belong to developed countries, while Mega cities and Big cities which are on the IN category (the most dynamic group) belong to developing ones . For details see Appendix 1.2.

Subsequently, we will present in more detail the different jumps by regions, considering the changes on the number of cities in each category.

[15] Gibrat's law has been broadly studied; most of the authors such as Gabaix (1999b), Ionnides and Overman (2000; 2003) agree with it; however Rosen and Resnick (1980) and Black and Henderson (2003) do not; therefore it remains as a controversial issue.

Table 1.16. "Jumps" in city category by regions (1960-2000)

Asia

	1	2	3	4	5
1	1	-	-	-	-
2	4	-	-	-	-
3	5	10	5	-	-
4	1	3	49	29	-
5	-	-	33	157	473

Total changes	262
Total cities	770
% of changes	34%

Africa

	1	2	3	4	5
1	-	-	-	-	-
2	-	-	-	-	-
3	1	-	1	-	-
4	1	-	6	1	-
5	-	1	15	41	105

Total changes	65
Total cities	172
% of changes	38%

Latin America and Caribbean

	1	2	3	4	5
1	-	-	-	-	-
2	2	-	-	-	-
3	2	2	-	-	-
4	-	1	11	4	-
5	-	-	13	49	235

Total changes	80
Total cities	319
% of changes	25%

Western Europe

	1	2	3	4	5
1	-	-	-	-	-
2	-	3	-	-	-
3	-	-	14	-	-
4	-	-	3	25	4
5	-	-	1	12	181

Total changes	20
Total cities	243
% of changes	8%

Eastern Europe

	1	2	3	4	5
1	-	-	-	-	-
2	-	1	-	-	-
3	-	1	2	-	-
4	-	-	5	21	-
5	-	-	-	23	172

Total changes	29
Total cities	225
% of changes	13%

Offshoots (USA, Canada, Australia, New Zealand)

	1	2	3	4	5
1	1	-	-	-	-
2	1	1	-	-	-
3	-	-	13	-	-
4	-	-	16	25	-
5	-	-	1	53	84

Total changes	71
Total cities	195
% of changes	36%

Legend

area of no changes

City Codes: 1- Mega cities; 2 - Big cities; 3-Midsize cities; 4- Small cities; 5-Towns

Source: Urban dataset, our elaboration.

Africa is the region with more jumps of categories, where 38% of the observed cities have changed their hierarchy to a higher level. In this region, the jumps are concentrated in cities of lower order (first urban frontier); indicating an intensive rural-urban migration. Additionally, Africa presents two "traumatic jump" it means, cities that have changed their category in two or more superior levels. These are Lagos (Nigeria) and Kinshasa (D.R. Congo) which had similar historical events. Nigeria in 1960 became an independent state and in 1967 started a civil war; once it finished, the country continued a long road towards democracy. The case of the Democratic Republic of Congo is similar; after its independence in 1960, it suffered two wars and a strong social chaos. These types of traumatic urban jumps are certainly explained by the effects of *warfare on city growth*, studied by Glaeser and Shapiro (2001).

The second region with more jumps is Offshoots. This is not a surprise after reviewing its tendency of urban growth (Graph 1.3). Since XVIII century, Offshoots became the most important *attraction pole for migrants*, fact that has not changed up to now. It's interesting to see that the cities with the most important jumps are Los Angeles (from Big to Mega) and Riverside (From Town to Midsize): both located in California, which has received great waves of migrants from all around the world. As a matter of fact, in 1996 about 22% of all US foreign immigrants were living in California (citydata.com).

The third region in the ranking of changes is Asia. This region presents great mobility in its jumps among all the categories, which is an indicator of a deeper structural change in their urban setting. Ten cities became Mega, thirteen Big and eighty two Midsize. Most of the jumps belong to China and India, which presented large cities before entering in a process of fast *industrialization*. As it is indicated by Rosen and Resnick (1980), many countries suffer "over-urbanization" because the highest-ranking cities (most populous) take advantage of the economies of scale, generating higher attraction.

The fourth region is Latin America with 25% of changes. A closer analysis of its changes shows that the countries with relevant changes are Brazil, Colombia, Chile, and Peru. Brazil is a typical case of hyper-urbanization, where the phenomenon of industrialization (technological advance) as Kelley and Williamson (1984) underlined, impels rural-urban migration. The rates of urbanization growth are higher than the rates of formal employment growth, resulting in the development of a vast informal sector. Additionally, Feler and Henderson (2009) studied the exclusionary urban policies in Brazil and their effect on increasing the *informal sector of housing*; the lack of appropriate housing regulations contributed with the hyper-urbanization.

On the other hand, jumps among Colombia, Chile and Peru seem to be characterized by the effect of *revolutions, terrorism and dictatorship*, aspects that have been studied by Ades and Glaeser (1995).

At last, the regions with fewer transformations are Western and Eastern Europe. Western Europe presents four cases of city jumps to an inferior level, from category 4 to 5. These are the cases of Antwerpen (Belgium), Hague (Netherlands), Dresden and Leipzig (former East Germany).

To deepen this analysis, we present in Table 1.17 the cities which suffered the strongest transformation (traumatic changes) in the last 40 year.

Table 1.17. Traumatic changes: Jumps of two or more categories into level Big or Mega

City	Country	Change of category	City pop. rate of growth	Country Income classification	Country size*
Dhaka	Bangladesh	From 4 to 1	1665%	Low income	Large
Lagos	Nigeria	From 4 to 1	1656%	Lower middle income	Large
Kinshasa	Dem. Rep. Congo	From 5 to 2	1023%	Low income	Small
Karachi	Pakistan	From 3 to 1	539%	Lower middle income	Large
Hyderabad	India	From 4 to 2	450%	Lower middle income	Large
Delhi	India	From 3 to 1	412%	Lower middle income	Large
Bogota	Colombia	From 4 to 2	383%	Upper middle income	Middle
Manila	Philippines	From 3 to 1	379%	Lower middle income	Large
Lahore	Pakistan	From 4 to 2	378%	Lower middle income	Large
Bangalore	India	From 4 to 2	374%	Lower middle income	Large
Mumbai	India	From 3 to 1	346%	Lower middle income	Large
Jakarta	Indonesia	From 3 to 1	311%	Lower middle income	Large
Sao Paolo	Brasil	From 3 to 1	279%	Upper middle income	Large
Cairo	Egipt	From 3 to 1	186%	Lower middle income	Large
Rio de Janeiro	Brasil	From 3 to 1	116%	Upper middle income	Large

Source: Urban dataset, World Bank classifications; own elaboration

* Country size classification: Small < 10 mill. Inhabitants; Middle from 10 to 70 mill; Large > 70 mill

All of these cities belong to developing countries, with a low or middle-low level of income and large population size (more than 70 millions). It is not a surprise that these agglomerations host the world's biggest slums, such as Dharavi in Mumbai and Orange Town in Karachi, or the well known *kampungs* in Jakarta and the *favelas* in Rio or São Paulo.

Nowadays, the population living in slums is about 830 millions (UN World Urbanization Prospects, 2007) and according to the United Nations, it will double by 2030, becoming as much people as the whole world's population at the beginning of the XX century. Table 1.18 shows the percentage of urban population living in slums in 2010 among the different world's regions.

Table 1.18. Percentages of Urban Population Living in Slums (%)

Major region or area	2010
Sub-Saharan Africa	62%
Southern Asia	35%
South-Eastern Asia	31%
Eastern Asia	28%
Western Asia	25%
Oceania	24%
Latin America and Caribbean	24%
Northern Africa	13%

Source:UN World Urbanization Prospects (2007)

As we have seen, the most important changes in the urban structure occurred among developing countries. These changes can be explained by several factors, such as insecurity (warfare and terrorism); industrialization with the consequent mismatches between formal employment growth and rural-urban migration; lack of housing regulations and political instability (revolutions, dictatorship). Theses causes require a deeper theoretical background, which will be presented in Chapter 2.

1.4.3. Urban Hierarchies: Analyzing Zipf's Parameters

Zipf (1949) –following Auerbach (1913)- considered that the hierarchical distribution of cities is explained by a stable parameter of 1 (β=1; Zipf's law) corresponding to the next relation:

$$\ln R = \alpha - \beta \ln\left(POP_R\right)$$ (see details in Box 1.1. below)

Box 1.1. Zipf's law

$$\ln R = \alpha - \beta \ln\left(POP_R\right)$$

Where R = rank = n (from 1 on).

The basic idea is that the population of the R-ranked city is linked to the population of the primate city in the following manner:

$$POP_R = \frac{1}{n} POP_1;$$

So we can write

$$\ln(n) = \alpha + \beta \ln(n) - \beta \ln(POP_1)$$

Then α is equal to

$$\beta \ln(POP_1)$$

because

$$0 = \alpha + 0 - \beta \ln(POP_1)$$

As a consequence, the expected value of β is 1.

When β is below 1 a higher hierarchy or distances between city sizes is observed. It means that the distribution of city sizes is uneven; far below 1 indicates an extreme hierarchical urban structure or very uneven. When β is equal to 1, the Zipf's law holds –it is also called the *rank size rule* - which means that there is a proportionate or even distribution of city sizes where the population in the second city is half of the primate, the third city, a third of the primate, and so on (Gabaix and Ionnides, 2003). When β is over 1, it indicates that the distribution of cities is more evenly distributed than predicted by the rank size rule (Rosen and Resnick, 1980). As example, in our Urban dataset Thailand appears with a low parameter; in the rank size rule Belgium and with a very high β Netherlands.

The Zipf's law, is considered a robust empirical regularity. One of the problems behind the Zipf's law is the lack of a strong theoretical background. Krugman (1996), in his study on the "mystery of urban hierarchy", acknowledges that the closest explanation to this phenomenon is given by Simon's (1955) random growth model:

> "Simon envisaged a process in which the urban population grows over time by discrete increments -call them ''lumps''- [...where] a city is simply a clump of lumps, whose expected growth rate is independent of size. (...) There would be little reason to take such a model seriously, except for one thing: the size distribution of cities does follow a power law and Simon's model both predicts this result and gives at least a hint why the size distribution might have remained stable despite huge changes in technology and economic structure." (Krugman, 1996:410).

Henderson (2010), underlines that it is precisely the consistent stability of the distribution of city sizes that has "sparked" the Zipf's law literature, fact that is deeply linked with the Gibrat's Law.

> "If the upshot of these stochastic events is that individual city growth rates follow Gibrat's Law (the growth rate at any instant is independent of size), then Zipf's Law will emerge." (Henderson, 2010:527)

The literature on the stability of cities distribution is abundant and it is a difficult task to make a selection of the best studies; one of the first contributions was written by Alexandre Le Maître (1682) quoted by Eeckhout (2004) - who observed a "systematic pattern" in city size distribution. Later on, Krugman (1995), Gabaix (1999), Black and Henderson (1999) among others, make reference to the robustness of the mentioned stability.

A milestone among empirical studies on city sizes distribution is Rosen and Resnick (1980), who studied the stability of the Zipf's law in 44 countries. The authors concluded that the Zipf's parameter is only a "first approximation" on the distribution of city sizes, because the parameter is sensible to economic, demographic and geographic variables.

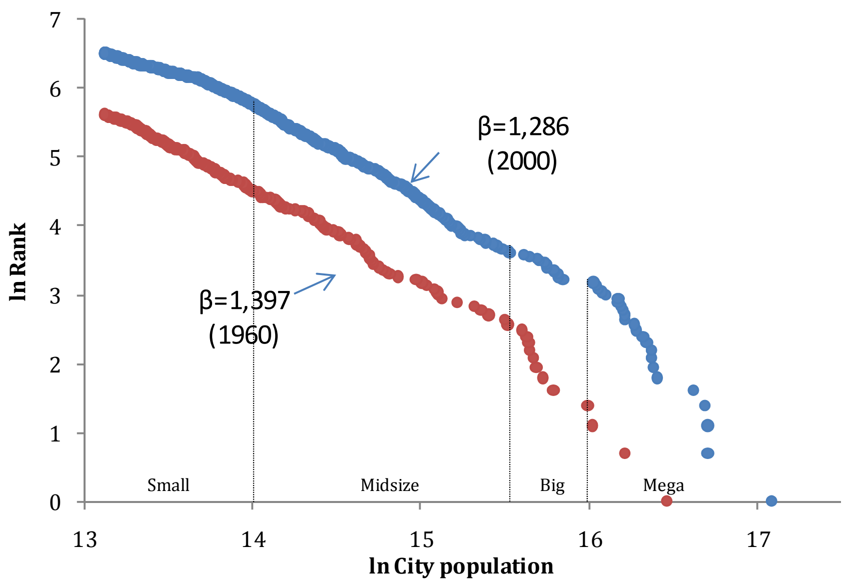
Soo (2005) analyzing 73 countries, found that the variations in the Zipf's law are better explained by political variables (i.e. political rights and civil liberties) rather than geo economic ones (i.e. transport costs, trade). Most of the researches regarding this issue are country-based, although the distribution should be valid in a different context.

Henderson and Wang (2007) analyze the worldwide distribution of cities sizes, between the year 1960 and 2000, using three types of comparisons:

> "First, we compare plots of size distributions, then spatial Gini coefficients, and then coefficients from estimation of Pareto distributions [...concluding that] over the last 40 years there has been almost no change in the relative size of distribution of cities" (Henderson and Wang, 2007: 290).

Following this study, we analyze below the changes in the Zipf's parameter for all the cities size using our dataset, cutting off Town sizes. Additionally, to deepen the analysis we compute the Zipf's parameter within each group of cities sizes. This contributes to observe the variability of the parameter in each category of city.

Figure 1.7. Zipf's parameter in world's cities in 1960 and 2000[16]



Observations: 1919
Source: Urban dataset. our elaboration

We found that the β coefficient for the year 1960 is 1,397 and for the year 2000 it reduces its level to 1,286. These results give us three main indications. First, as the literature underlines, the hierarchy level of the world's cities is surprisingly stable although its dynamic growth already analyzed. Second, as Rosen and Resnick

[16] In Figure 1.7 the log city population (x-axis) for Small city sizes is located between 13 and 14; Midsize cities from 14 to 15,5; Big cities from 15,5 to 16 and Mega cities over 16. For y-axis 0 corresponds to the city of rank 1 (largest).

(1980) pointed out, the distribution of cities sizes is more even than we expected. Third, we observe that the hierarchy level has experienced a slight increase.

In Table 1.19. we present the results of Zipf's paramenter by each group of cities. The results show that the slightly increase in the hierarchy level of the world's urban structure is basically due to the changes in the group of Big cities (β from 2,90 to 1,05) and Small cities (β from 1,29 to 0,9); both groups represented in 2000 about 35% of the sample of population.

Table 1.19. Evolution of the Zipf's parameter by city category

City Size	1960 (nk0)	2000 (nk1)
Mega & Big	**2,735**	**2,074**
Mega	2,71*	3,213
Big	2,895	1,045
Midsize	**1,426**	**1,433**
Small	**1,299**	**0,901**
All sample (n)	**1,397**	**1,286**

Source: Urban Dataset, our elaboration.

* Values are not representative, given the low number of observations.

The group that becomes extremely interesting is Midsize cities, due to the stability of the parameter (β from 1,426 to 1,433). But, why does this group remain so stable? The answer is not simple. The literature not always shares the same definition of medium or midsize cities. Rosen and Resnick (1980) pointed out that intermediate-sized cities are less prone to diseconomies of agglomeration than large agglomerations; additionally they indicated that intermediate-sized cities would contribute to approximate Zipf's distribution. These important indications highlight how middle cities give stability to the urban structure.

The group of Small cities shows an increase on its level of hierarchy; which means that the differences within the group have been enlarged as a result of two different changes: (1) the increasing urbanization towards the Midsize level has pulled the larger small cities, and (2) the dynamic growth among the Town sizes has turned many towns into Small cities. As a result, the group became more uneven.

For Henderson (1997), middle size cities tend to be economically specialized due to the process of local knowledge generation and the particularities of internal economies of scale in cities of this size. This consideration could indicate that their size is near to the optimal, because they capture the benefits of industrial specialization without suffering large diseconomies of agglomeration.

What could happen if a country presents one Mega or Big city and a large set of Small cities and Towns, but not a o of Midsize cities? The answer is not simple, because of the different elements that interact in the process of agglomeration. However it is feasible to think that a country that has not a Midsize city network has higher probabilities to experiment a "catastrophic agglomeration" as described by Nijkamp (1980).

1.4.4. The City Primacy

After analyzing the Zipf's parameter for the different city categories, it becomes necessary to deepen one of the most important elements of the hierarchical structure of the urban setting: the primate city.

The urban primacy can be measured in different ways; however the most common methodology is the relation between the population of the biggest city on the total urban population of a country[17].

The study of primate cities has attracted great interest among researchers such as Wheaton and Shishido (1981), Krugman and Livas (1992), Ades and Glaeser (1995), Gaviria and Stein (2000), Henderson (2000), Davis and Henderson (2003). Many of their studies have been focused on identifying the main drivers that boost primacy, contributions that will be reviewed in chapter 2. Table 1.20 shows highest and lowest primacy levels in different world's regions.

As a matter of fact, the first element that arises is the role of geography. Small countries –in terms of land- are at the top of the primacy ranking, characterized by being islands (i.e. Singapore) or small inland countries (i.e. Djbouti or Central American cities). At the opposite side for the level of primacy appear very large countries such as China, India, Russia. Lösch (1954) considered that the availability of agricultural land was a key element to disperse agglomeration. Additionally, Krugman (1991) pointed out that a dispersed agricultural hinterland, which implies high transport cost, is an incentive to set up new facilities to serve these areas; the extension and dispersion of land and population are centrifugal forces.

[17] Primacy $=P_1/UP$, where P_1 is the population in the primate city and UP the total urban population of the country to which that primate city belongs.

Table 1.20. Primacy by geographic regions: ranking of top and bottom countries (year 2000).

Africa

Top 5	
Country	Primacy
Liberia	0,88
Djbouti	0,83
Guinea-Bissau	0,72
Guinea	0,70
Congo Republic	0,70
Bottom 5	
Country	Primacy
South Africa	0,12
Cameroon	0,21
Sudan	0,22
Ghana	0,23
Morocco	0,23
Total obs. AFR	36
Average	0,40
Standard dev.	0,17

Latin Amer. & Caribbean

Top 5	
Country	Primacy
Jamaica	0,68
Dominican R.	0,65
Guatemala	0,64
Panama	0,60
Paraguay	0,43
Bottom 5	
Country	Primacy
Brazil	0,13
Venezuela	0,14
Colombia	0,22
Mexico	0,25
Cuba	0,27
Total obs. LAC	21
Average	0,37
Standard dev.	0,15

Asia Middle East

Top 5	
Country	Primacy
Hong Kong*	1,00
Singapore	0,89
Syria	0,87
Lebanon	0,63
Kuwait	0,55
Bottom 5	
Country	Primacy
China	0,03
India	0,06
Malaysia	0,10
Indonesia	0,13
Kazakstan	0,15
Total obs. ASI	35
Average	0,34
Standard dev.	0,20

Eastern Europe

Top 5	
Country	Primacy
Latvia	0,48
Croatia	0,43
Estonia	0,43
Hungary	0,28
Belarus	0,25
Bottom 5	
Country	Primacy
Ukraine	0,08
Russia	0,09
Poland	0,15
Slovakia	0,15
Czech	0,16
Total obs.EEU	15
Average	0,24
Standard dev.	0,12

Western Europe

Top 5	
Country	Primacy
Portugal	0,69
Iceland	0,66
Greece	0,48
Ireland	0,44
Austria	0,39
Bottom 5	
Country	Primacy
Netherlands	0,09
Germany	0,11
Italy	0,11
Belgium	0,11
Spain	0,13
Total obs.WEU	16
Average	0,28
Standard dev.	0,19

Offshoots

Top 5	
Country	Primacy
New Zealand	0,33
Australia	0,22
Bottom 5	
Country	Primacy
Canada	0,19
United States	0,07
Total obs.OFF	4
Average	0,20
Standard dev.	0,11

World

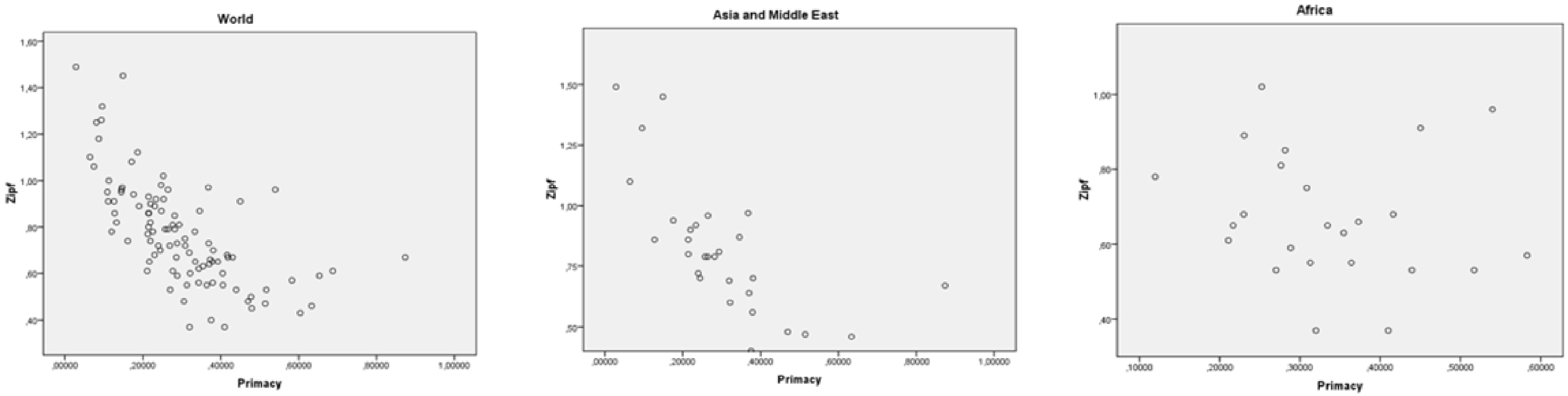
Top 5	
Country	Primacy
Hong Kong	1,00
Singapore	0,89
Liberia	0,88
Syria	0,87
Djbouti	0,83
Bottom 5	
Country	Primacy
China	0,03
India	0,06
United States of	0,07
Ukraine	0,08
Congo Republic	0,08
Total obs. Worl	126
average	0,34
Standard dev.	0,18

*Is considered although it is not a country due to its administrative characteristics.

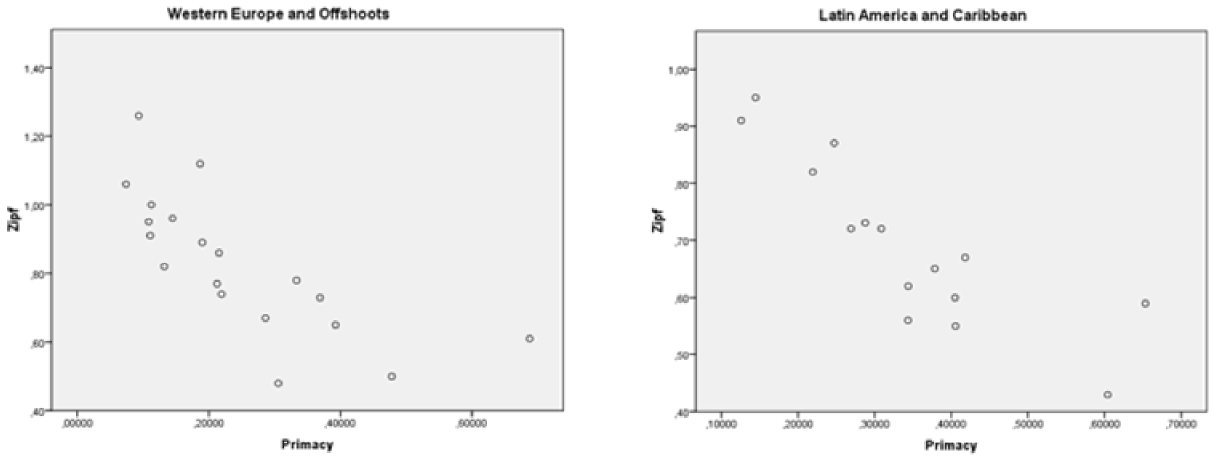
Source: Urban dataset, our elaboration.

To deepen our analysis, we present in Figure 1.8 the relationship between the primacy level and the Zipf's parameter in the world's regions. Firstly, all the regions except Africa, present a negative and significant relationship, as expected: higher level of primacy implies lower Zipf's parameter (high hierarchy). Hence, most regions have established their urban systems in a more or less efficient way. Secondly, the lack of correlation between these elements in the African continent indicates that this region has not developed at least a basic urban structure. Low levels of urbanism, deficient productive transformations and weak democracies, among other elements have obstructed the shaping of a basic urban setting; therefore we expect that in Africa, the characteristics of non-performing urbanism are predominant.

Figure 1.8. Correlation between Zipf's parameter and Primacy



Correlation	Zipf's 95 vs Primacy_00	No. Obs.
WORLD	-,663**	99
AFR	-,160	24
LAC	-,852**	15
ASIA&ME	-,681**	29
WEU&OFF	-,744**	19



Source: Urban dataset, our elaboration

1.4.5. The Raise of Mega Cities

In the last years, mega cities have caught the attention of many scholars and policy makers due to their astonishing growth and their increasing role in political and economic issues. As we have already seen (Table 1.10), Mega cities hold about 16% of global urban population of most visible cities (Urban dataset) but only 5% of the world's population (Table 1.5). They have experimented in the last forty years an average increase on their population of 166% (Table 1.15), the highest average rate of growth among the five categories of cities.

Nowadays, much of these cities are considered "world cities" (Hall, 1966), "global cities" (Sassen, 2001) or "global cities-regions" (Scott , 2001); concepts that capture the idea of the emergence of new global actors (large and connected cities) which concentrated great amount of economic and social activities, resulting in new spaces of global integration and competition. In this way, Mega cities can have important international knowledge functions (Florida *et.al.*, 2008), favoring commerce and advanced forms of production that tend to generate global networks, also beyond national boundaries.

However, not all large agglomerations are global cities. Much depends on their capacity to be globally interconnected through specific networks (see Castells, 2002); hence global cities are not basically characterized by absolute sizes, rather by their capacity of being linked and integrated in global dynamics. There are Mega cities much more isolated and self-contained, which are not a "node" in a global network; often these agglomerations are prone to become chaotic places (see Short, 2008).

Under the NEG perspective (see for instance Krugman and Livas, 1992), regions (or agglomerations) of countries more globally integrated (trade openness), will tend to present less forward and backward linkages in the local market or region; hence it is expected regional convergence or people disperse in the national territory. In other way, when the country is isolated (trade closeness), then strong forward and backward linkages in one agglomeration will tend to create a very large city, producing regional divergence.

As it can be observed, different perspectives are giving more attention to the study of large agglomerations. In this context, Junius (1999) acknowledged two main approaches in the literature. The first one considers that primacy increase up to a certain level of economic development and then it begins to decrease. The second one indicates that behind large agglomerations there are important geographic and historical elements rather economic ones.

Soo (2005) remarks, that the role of economic elements and economic policies remain essential to understand particularities behind the urban structure; hence the second approach indicated by Junius would have low explanation power.

Short and Peralta (2009) pointed out that understanding the causal connections between primacy and economic growth remains a difficult task, because complex historical and geographic elements interact particularly in a more globalized world, reality that demands to reopen the debate on urban primacies.

According to the analysis that we have done until now, it seems that different institutional, economic and geographic variables interact dynamically in shaping large agglomerations.

A clear fact in this debate is that rampant mega city growth seems to be stronger among developing countries (see Table 1.21 below).

In 1950, the two existing Mega cities belonged to US and Japan. In 1980, two out of four Mega cities belonged to the developing world; since then an explosion in the number of mega cities has been verified. In 2010, only five of the twenty one Mega cities belonged to the developed world, and the projections are not different. For the year 2025 it is expected the raise of eight more Mega cities, all of them located in developing countries.

This "big picture" of raising Mega cities leaves some open questions: (1) are these mega agglomerations related to economic growth and changes in the production structures (i.e. Mega cities in China and India) becoming powerful centers of production that generate complex technological externalities?; or (2) is this new urban phenomenon the result of an insecure environment, political instability, poverty (i.e. Dhaka, Karachi, Lagos, etc.), that are becoming spots of social instability (growing inequality) with increasing diseconomies of agglomeration? (3) are these Mega cities the "best" way to enhance economic growth?

Certainly, the increasing protagonism of Mega cities is attracting the attention of scholars and policy makers. Currently, the most efficient urban structure to support economic growth is an open and complex debate:

> "How spatially concentrated should urbanization be; how much development should be focused in mega-cities, or huge urban clusters, as opposed to spatially dispersed. This is a critical question, facing China and India today, with fairly radical proposals on the table which we will discuss for extraordinarily concentrated development, with huge portions of the population to potentially be housed just in megacities. The more concentrated the development the more rural populations have to up-root themselves and migrate longer distances to focal points of urbanization. Whatever an optimal pattern might be, how costly are deviations, even significant ones from that optimal pattern?"(Henderson, 2010:516)

Ambitious policies of creating huge urban centers to boost economic growth put forward diverse questions about impact, efficiency and sustainability, due to the fact that in current Mega cities, mostly located in developing countries, serious social and environmental problems do not allow an adequate quality of life. Schumacher (1975), reflecting about the problems of megapolis, underlined that those cities require a very high rate of oil-based economic metabolism, which demand enormous resources to obtain better standards of living, which finally are not achieved.

Table 1.21. Evolution and forecast of emerging Mega cities (1980-2025)

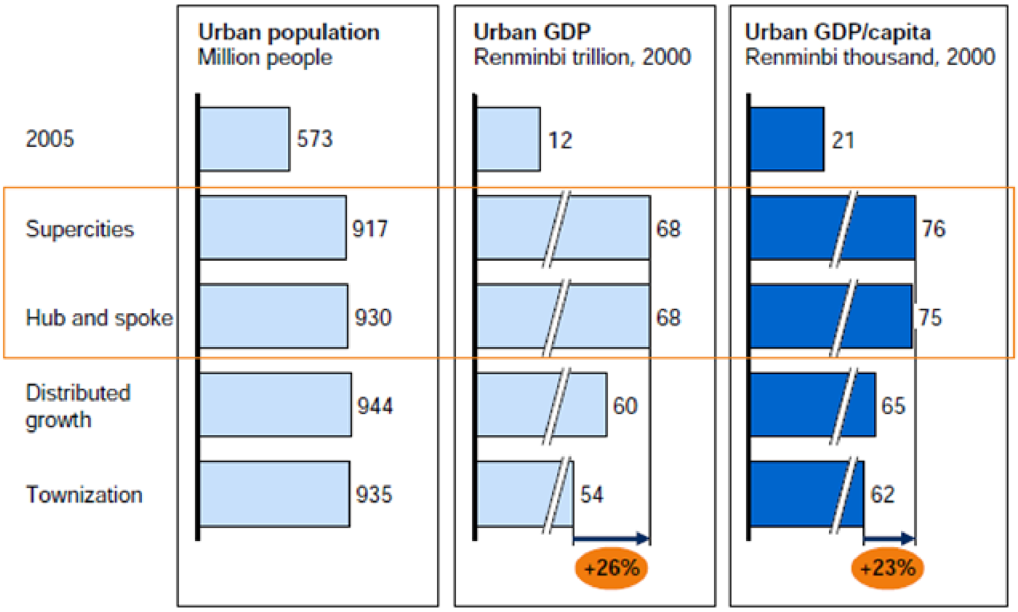
1950			1980			2010			Forecast 2025		
Rank	City	Pop. (Mill.)	Rank	City	Pop. (Mill.)	Rank	City	Pop. (Mill.)	Rank	City	Pop. (Mill.)
1	New York-US	14,2	**1**	Tokyo	28,6	**1**	Tokyo	36,7	**1**	Tokyo	37,1
2	Tokyo	11,0	**2**	New York-US	15,6	**2**	Delhi	22,7	**2**	Delhi	28,6
Mega cities in developed countries 2 out of 2			**3**	Ciudad de Mexico	13	**3**	São Paulo	20,3	**3**	Mumbai	25,8
			4	São Paulo	12,1	**4**	Mumbai	20,0	**4**	São Paulo	21,7
			Mega cities in developed countries 2 out of 4			**5**	Ciudad de México	19,5	**5**	Dhaka	20,9
						6	New York-Newark	19,4	**6**	Ciudad de México	20,7
						7	Shanghai	16,6	**7**	New York-Newark	20,6
						8	Kolkata (Calcutta)	15,6	**8**	Kolkata (Calcutta)	20,1
						9	Dhaka	14,6	**9**	Shanghai	20,0
						10	Karachi	13,1	**10**	Karachi	18,7
						11	Buenos Aires	13,1	**11**	Lagos	15,8
						12	Los Angeles,Lbeach,S	12,8	**12**	Kinshasa	15,0
						13	Beijing	12,4	**13**	Beijing	15,0
						14	Rio de Janeiro	11,9	**14**	Manila	14,9
						15	Manila	11,6	**15**	Buenos Aires	13,7
						16	Osaka-Kobe	11,3	**16**	Los Angeles,Lbeach,S	13,7
						17	Al-Qahirah (Cairo)	11,0	**17**	Al-Qahirah (Cairo)	13,5
						18	Lagos	10,6	**18**	Rio de Janeiro	12,7
						19	Moskva (Moscow)	10,5	**19**	Istanbul	12,1
						20	Istanbul	10,5	**20**	Osaka-Kobe	11,4
						21	Paris	10,5	**21**	Shenzhen	11,1
						Mega cities in developed countries 5 out of 21			**22**	Chongqing	11,1
									23	Guangzhou, Guangdo	11,0
									24	Paris	10,9
									25	Jakarta	10,8
									26	Moskva (Moscow)	10,7
									27	Bogotá	10,5
									28	Lima	10,5
									29	Lahore	10,3
									Mega cities in developed countries 5 out of 29		

Source: UN World Urban Prospects 2005 and 2009, own elaboration.

Analyzing Chinese urban trends and its economic development targets, the McKinsey Global Institute (2009) suggest that China has four possible paths to achieve, through urbanization, its target of quadrupling GDP per capita by the year 2020. Two of these scenarios are *concentrated urban patterns* and two other are *disperse urban patterns*. The "concentrated" scenario is based either on "supercities" (more than 20 million people each) or "hub and spoke" cities (about 60 million people each); the "dispersed" scenario considers also two paths, one based on a large number of Midsize cities (1.5 to 5 million) and the other called "townization" with smaller cities with less than 0.5 million. McKinsey considers that the most efficient is the concentrated urban pattern (see Figure 1.9) although a scenario with Midsize cities could be also prominent.

> "In these scenarios, midsize cities, which will have the largest share of middle-class consumers, will emerge as the engines of growth over the next 20 years. Although each scenario presents a largely distinct set of opportunities and challenges (...) the concentrated growth scenarios appear to be most optimal" (McKinsey Global Institute, 2009:27).

Figure 1.9. GDP and Chinese Urban Structure: McKinsey's Scenarios (2005 and 2020)



Source: McKinsey Global Institute, Preparing for China's urban billion (2009)
Note:Slash indicate the trend growth without urban policy.

The consideration of Henderson (2010) on this type of proposal and scenarios is prudent:

> "Whether constructed as super cities or giant urban network regions, we know little about the efficacy of such size urban areas."(Henderson, 2010:531)

Another proposal on urban policies as driver for growth is Romer's (2010) initiative on "charter cities"[18]. The idea seems to be linked to the concept of modern city-states such as Singapore, where strong institutions and rules are able to create new urban spaces that offer new opportunities for poor peasants trapped in traditional ways of production with less economic and social mobility.

It can be synthesized with Romer's words:

> "China's *special economic zones* demonstrate the potential in urbanization to create entirely new places, which were sparsely populated before, that could be operated under different sets of rules. The challenge for developing countries is to do something similar to drive changes in the rules within their existing systems of governance. There are many places along the world's coastlines that could host *new cities of 10 million* or so residents at a population density similar to that of Hong Kong. Suppose that leaders in a developing country pick an essentially *uninhabited piece of land* of this size, *create a new set of rules*, and allow willing participants to opt in. Changing the rules for a nation as a whole using existing political mechanisms forces leaders to persuade and sometimes coerce everyone to change what they are doing." (Romer, 2010:9, with our italics).

Romer's idea is to create new Mega cities in developing countries, settled under a special legal frame, where people would live in a perfect oasis among the urban chaos of emerging countries. This "charter cities" would constitute a "development model" for other urban centers that would induce a structural change in the whole country.

Although the existence of technologies to manage large urban centers, we ask if it's feasible to carry out this type of policy in developing countries where Mega cities are facing severe institutional and environmental problems?

In our opinion, this idea of charter cities is not realistic because it does not consider the initial conditions of countries that should develop these urban projects, such as the quality of institutions, skilled workers, local culture, financial constraints and potential problems of corruption which can block the development of these new mega cities.

Under a different perspective the European Union, based on its historical evidence of urban development, has adopted a policy which explicitly pursues polycentric urban structures. This policy is known as the Leipzig Principles (1994), which were approved during a preparation meeting for the European Spatial Development Perspective, which state that:

> "… a polycentric urban system, as balanced as possible, discouraging excessive concentration around some large centers and the marginalization of peripheral

[18] For more information about charter cities see www.chartercities.org

> areas […additionally] maximizing inward investment in peripheral regions may also provide significant benefits to those central regions presently suffering from congestion, a deteriorating environment and demographic pressure due to their over-development (Bundesministerium für Raumordnung, Bauwesen und Städtebau, 1995, p. 57)[19]."

This approach promotes equilibrated urban systems policies that pursue balanced regional development, reduce the regional unbalances, increase competitiveness and sustainable development (ESPON 1.1.1., 2004).

The European Union tries to achieve an adequate urban structure characterized by low levels of hierarchy. However, the hypothesis of the polycentrism's benefits is not simple to test. This fact has been acknowledged by the same European Spatial Planning Observatory Network (ESPON):

> "…polycentricity is depicted here as a potential leverage (to be used by planners and policy-makers) to develop an efficient spatial planning policy ("most beneficial from a social and economic point of view"). Even though this could be a result of the analysis, it might be more appropriate in a research context not to take for granted such assumptions which have an incidence on the conceptual framework of the study and on its methodology, where the normative discourses are abusively implemented into unquestioned research hypotheses." (ESPON, 2007:216).

Therefore, the debate on which urban structure (concentrated urban patterns or disperse urban patterns) fits better for development remains open, especially in a context where several Mega cities are raising among developing countries.

1.5. Linking Urban Structure with Economic and Spatial Variables

To understand the possible links between urban structure and growth[20] it is necessary to explore the diverse variables that interact inside the urban space. These variables, as we have already mentioned, are demographic, economic, geo-economic and institutional type.

1.5.1. Economic Growth and Urbanization

Which is the relation between the level of GDP per capita and the urbanization rates? This question has accompanied us since the beginning of this chapter and presents different complexities.

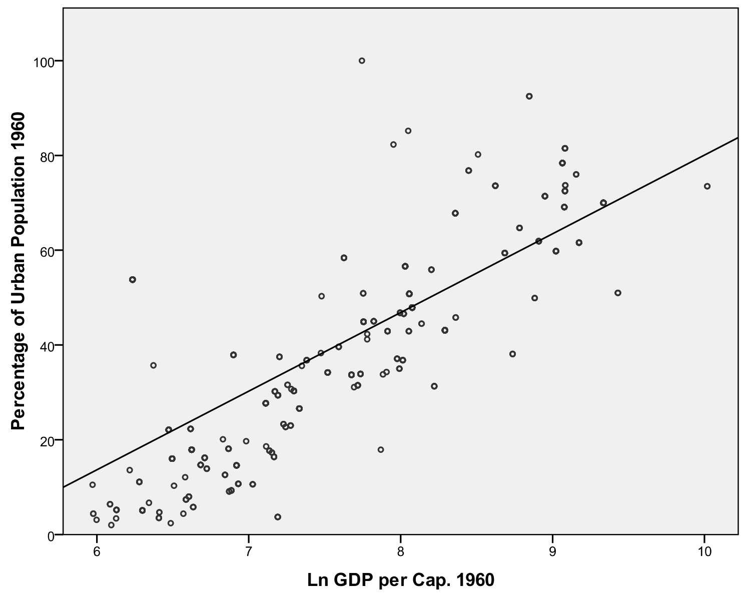
---

[19] Quoted by Böhme and Schön, 2006:394

[20] It's important to mention that in our analysis, changes in populations' growth or GDP are calculated by the difference between the logarithm of the analyzed variable in the time t minus the logarithm of the variable at time t-1, this relationship would be called "Change" (i.e. Change in Urban Population).

The *first observation* to point out is the *positive relationship between the level of economic development and urban population*, aspect that has been previously mentioned. Figure 1.10 shows this relation considering 114 countries from our Urban dataset.

Figure 1.10.ln GDP per Capita (1960) and Percentage of Urban Population (1960)



Source: Urban dataset; our elaboration.

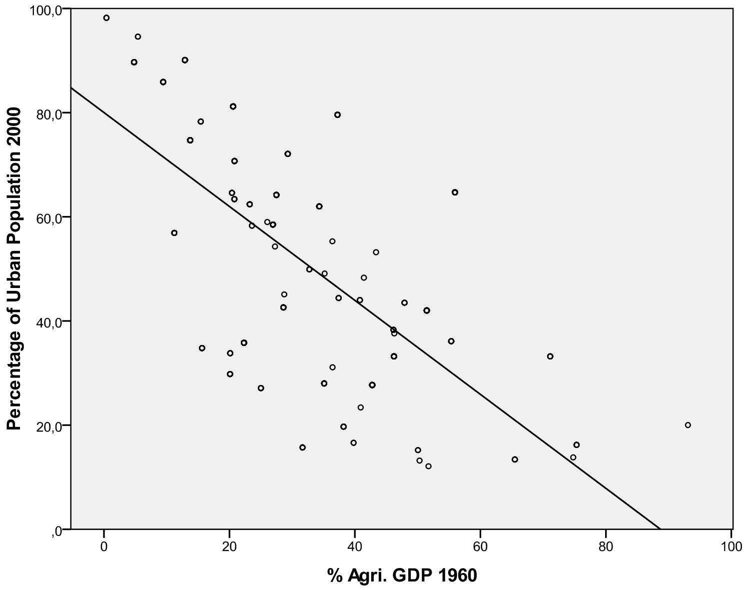
Without doubt, economic development does not occur without urbanization; however the causal links are not clear-cut, as Bertinelli and Black (2004) remark.

The *second observation* is an *inverse relation between the share of agriculture on GDP and the level of urbanization* (see Figure 1.11 which presents 56 observations).

As expected, countries that have a traditional productive structure or where agriculture prevail, tend to present less urban population; their economic activity is closely linked to non-mobile capital (land) and productive activities and population tend to follow the distribution of arable land.

On the contrary in an industrialized context, capital and skilled labor are located in areas with high market potential, usually more populated areas, to take advantage of economies of scale and higher wages. The new industries demand greater quantity of workers, generating a process of migration from the hinterland to the city. This phenomenon has been widely analyzed by Lewis (1954), who with his dual economic model presents how structural changes lead to rural-urban migration.

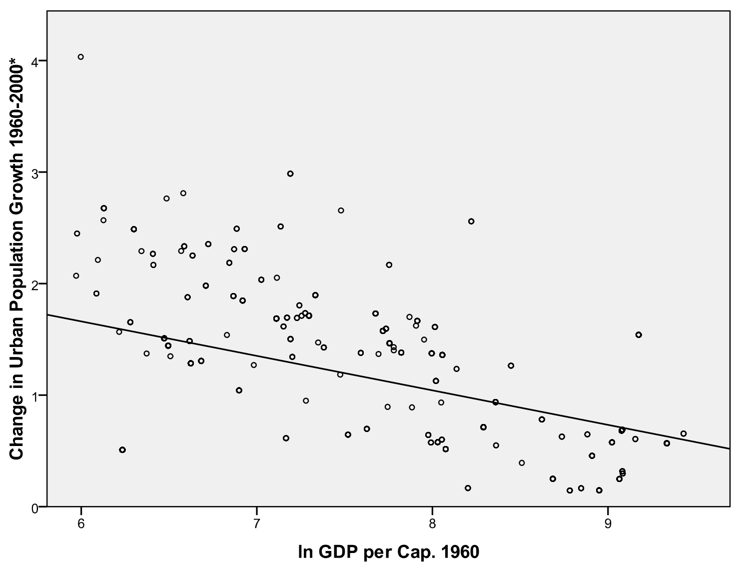
Figure 1.11. Percentage of Agriculture on GDP (2000) vs Percentage of Urban Population (2000)



Source: Urban dataset; our elaboration.

The *third observation* is the presence of a certain *"convergence" dynamic between the initial level of GDP per capita and the Change in Urban Population* (see Figure 1.12; with 114 observations); countries with higher level of income present lower rates of urban growth[21].

Figure 1.12.ln GDP per Capita (1960) Rate of Urban Population Growth (1960-2000)



Source: Urban dataset; our elaboration.
*The rate of growth: Ln (Urb.pop.00) - Ln (Urb.pop.60)

[21] We have already observed indications of this dynamic when we analyzed the net rate of urban population growth by regions (Figure 1.3).

Also a simple regression between urban change and the level of economic development (see Table 1.22.a) confirms the information given by Figure 1.12, where the coefficient is negative and highly significant; however the R square is low.

Table 1.22.a Change Urban Pop. (1960-2000) and lnGDP Cap. (1960)

Dependent variable Change Urban Pop. (1960 -2000)	Coeff.	t
Intercept	4,81	10,02
ln GDP cap 1960	-0,44	-7,00
Observations	114	
Adjusted R square	0,296	

Source:Urban dataset, our elaboration

This can be a symptom that changes in the economic structure pushes the urban development but, after reaching a certain "maturity" in the structural change, urbanization will continue to growth but at a lower rate.

However, if we introduce regional dummy variables (Table 1.22.b.), new hints arise. The regression increases significantly its R square; GDP per Capita turns to non significance and regional dummies only for developing regions become significant. This can be an indication that in developing countries the relationship between structural change and urbanization is not clear-cut.

Table 1.22.b. Change Urban Pop. (1960-2000) and lnGDP Cap. (1960) with regional dummies

Dependet variable Change Urban Pop.(1960-2000)	Coeff.	t
Intercept	0,71	1,23
ln GDP cap 1960	-0,02	-0,25
Dummy LAC	0,72	3,13
Dummy AFR	1,52	6,75
Dummy ASI&ME	1,10	4,96
Dummy WEI&OFF	-0,08	-0,32
Observations	114	
Adjusted R square	0,593	

To deepen the analysis, we have also regressed the change in the urban population on the change of GDP per capita in the period 1960-2000, from which emerges a negative relationship between economic growth and urbanization growth (see Table 1.23.a.).This could be seen as a contradiction to what we stated above.

Table 1.23.a. Change Urban Pop (1969-2000) and Change GDP cap (1960-2000)

Dependent variable Change Urban Pop. (1960 -2000)	Coeff.	t
Intercept	1,76	19,34
ln(GDPpc00)-ln(GDPpc60)	-0,44	-4,51
Observations	114	
Adjusted R square	0,145	

Source:Urban dataset, our elaboration

We do not think so. If we add to the relation measured in Table 1.23 regional dummy variables (see Table 1.23.b.) three relevant changes, as the one seen before, emerge:

- The R square goes from 0.14 to 0.60.
- The coefficient of the change in the GDP per capita becomes non significant.
- The regional dummies variables that belong to developing areas (Latin America, Africa, Asia and Middle East) are highly significant. Only the Western Europe and Offshoots countries dummy is not significant.

Table 1.23.b Change Urban Pop (1969-2000) and Change GDP cap (1960-2000) with regions

Dependent variable Change Urban Pop. (1960 -2000)	Coeff.	t
Intercept	0,68	3,17
ln(GDPpc00)-ln(GDPpc60)	-0,11	-1,44
Dummy LAC	0,67	2,93
Dummy AFR	1,45	6,50
Dummy ASI&ME	1,09	4,97
Dummy WEU&OFF	-0,09	-0,38
Observations	114	
Adjusted R square	0,601	

Source:Urban dataset, our elaboration

This is an indication that brings us to the *fourth observation*. In the process of urban growth, the regional *context matters*; hence there exist *other variables, beyond the economic ones, that are affecting the transformation of the urban structure, particularly among developing countries*.

As a consequence, it is important to analyze different spatial variables that could affect the level of urbanization, especially on its main urban phenomena: the primate cities.

1.5.2. Primacy and its Relations with Spatial Variables

As we have acknowledged, a fundamental aspect of urban structure is the dimension (absolute and relative) of primate cities, or main cities, given their growing role in the national and international economy.

With the aim of doing a first analysis about the relation between the levels of primacy and demographic, economic, geographic and geo-economic variables, we will present next a set of bivariate correlations[22]. At this moment, we would not include variables of institutional type because many of these are captured by dummy variables.

Primacy and urbanization

The first aspect to appoint (see Table 1.24) is the absence of correlation between the level of primacy and the share of urban population. The lack of correlation is coherent with the analysis already done, where we noticed that developed countries have still higher rates of urban population but generate less giant agglomerations than developing ones.

Additionally, the non correlation between primacy and the share of non urban population or its change (difference between 1960 and 2000) is quite obvious; people living in rural areas tend to be linked to agricultural activities following the distribution of arable land instead of urban centers; hence we expect less primacy.

Table 1.24. Bivariate correlations between Primacy and demographic structures

Demographic var.	Primacy 1960	Primacy 2000	Number obs.
shurb_60	,127		134
shurb_00		-,059	134
shnonurbp_60	-,070		134
shnonurbp_00		,104	134
shnonurbp_00 - shnonurbp_60		-,021	134

**. Correlation is significant at the 0.01 level
*. Correlation is significant at the 0.05 level
Source:Urban dataset, own elaboration

Primacy and economics

The correlation coefficients between primacy and economic variables are shown in Table 1.25. The first aspect to highlight is the change in the correlation coefficient between primacy and GDP per capita. In 1960 there is no correlation between these two variables, meanwhile in 2000 there is significant negative correlation

[22] To easy the reading of the next tables, we suggest to consult first the definition of variables used, available in Appendix 1.1. (Urban Dataset)

between the level of GDP per capita and the primacy. In other words, current primacies seem negatively linked to the level of income, indicating that this could be more related to a kind of non-performing urbanism. This observation is also linked to the fact that economic growth does not show a relation with current primacy levels.

Table 1.25. Bivariate correlations between Primacy and economic factors

Economic var.	Primacy 1960	Primacy 2000	Number obs.
ln(pcGDP_60)	,045		115
ln(pcGDP_00)		-,211*	130
ln(pcGDP00)-ln(pcGDP60)		-,154	115
Agr_GDP60	-,325*		56
Agr_GDP00		,176*	126
Gini_60	,169		105
Gini_00		,217*	111
trade_60	,369**		93
trade_00		,245**	132

**. Correlation is significant at the 0.01 level
*. Correlation is significant at the 0.05 level

Also the relation between the importance of agricultural sector in the economy and primacy show a strong change. In 1960, the correlation between these two variables was negative and significant. Countries with a more rural economic structure presented lower levels of primacy. However in 2000 the correlation between these variables become positive and significant, which is a clear indication that today many countries, that still have an economy with characteristics of backwardness, show higher levels of primacy; underdevelopment and higher primacy seem aligned.

A further confirmation is the result of the correlation between the Gini index and primacy in both periods; in 1960 this correlation was not significant, today inequality is positively linked to the level of primacy.

A final interesting result is the positive correlation between the share of trade in GDP *(openness)* and the primacy.

Fujita and Mori (1996) developed an evolutionary spatial economic model where they analyze the problem of main cities that are at the same time "port cities". They observe the emergence of an "agglomerative lock-in", where economic prosperity enhance the levels of primacy, in developed and developing countries.

> "…many ports cities (in particular, those in developed countries) have continued to prosper even though the initial advantage of cheap water access had ceased (…). Clearly, their continued prosperity can be explained only when we consider the

"lock-in effect" of some self-reinforcing agglomeration forces. (…) In many developing countries (such as Indonesia and Thailand), although their governments have striven to decentralize industry to the periphery, the lock-in effect of existing primal cities (which are mostly port cities) has been so strong that their effort have been unsuccessful." (Fujita and Mori, 1995:94-97)

For the authors main port cities suffer a problem of primacy irreversibility. It means that an increasing trade and economic prosperity could not necessarily reduce its primacy level. Indication that could explain the correlation observed.

On the other hand, Krugman and Livas (1992) – as we will see in the second chapter - developed a model that links trade policy and main cities in developing countries, where the absence of trade openness (as a result of protectionist industrial policies), boost economic agents to concentrate their commercial activities in the primate city transforming it in a giant city. According to them, a larger economic openness is linked to less primacy. This controversy requires further analysis, because both dynamics are taking place; hence it is required to observe if some of them prevail.

Primacy and geography

The previous considerations introduce the role of geography in defining primacy. The first aspect to consider is the significant and positive correlation between near coast[23] and primacy level (Table 1.26). A near coast position affects the localization of industries and offers favorable conditions to an agglomerative growth, because of migration and the effects of trade and market potential in the line of Fujita and Mori (1996).

Table 1.26. Bivariate correlations between Primacy and geographic factors

Geographic var.	**Primacy 1960**	**Primacy 2000**	**Number obs.**
Nearcoast	,282**	,255**	134
Distcoast	-,168	-,154	134
ln (Land)	-,483**	-,436**	134
ln (Agroland60)	-,424**		133
ln (Agroland00)		-,410**	132

**. Correlation is significant at the 0.01 level

*. Correlation is significant at the 0.05 level

Source:Urban dataset, own elaboration

[23] The variable "nearcoast" (near coast) is calculated by the "percentage of the land surface area of each country that is within 100km of the nearest ice-free coast." (Nunn and Puga, 2010). For further details see Appendix 1.1.

Recent data of the Global Rural Urban Mapping Project (GRUMP)[24], says that coastal environments concentrate 10% of the global area of urban land and gather approximately 65% of urban global population, which means a higher urban concentration than in any other ecosystems.

A second aspect to highlight is the negative and significant correlation between the size of the country (land area and agro land) and the primacy, confirming, the observation done before, that large countries such as China, India, Canada, US, Russia, present lower levels of primacy. Large distances imply high transport costs which, as Krugman (1991) underlined, are key factors generating centrifugal forces.

Primacy and geo-economics

Finally, it's important to analyze the link between the primacy and some others variables specifically geo economic, such as Zipf's parameter (urban structure), Internal Distance and Foreign Market Potential[25] (see Table 1.27).

A first observation regards the relevant negative correlation between the primacy and the Zipf's parameter. This relation is evident because a higher primacy hierarchize the urban structure meanwhile a higher Zipf's parameter indicates a less equal urban structure.

Table 1.27. Bivariate correlations between primacy and geo-economic indicators

Geo-economic var.	Primacy 1960	Primacy 2000	Number obs.
Zipf's value	-,503**	-,663**	99
ln(INT_dist)	-,503**	-,463**	133
FMP_60	-,206*		108
FMP_00		-,235**	131

**. Correlation is significant at the 0.01 level

*. Correlation is significant at the 0.05 level

Source: Urban dataset, our elaboration

We also verify that countries with a higher internal distance tend to generate lower levels of primacy. This is because the indicator of internal distance is based on geographic distances (between consumers and producers); hence its relation with primacy is similar to the indicator of geographic distances, where larger countries tend to have less primacy. Additionally, a negative relationship is

[24] For more details see the Global Rural Urban Mapping Project (GRUMP), Columbia University. http://beta.sedac.ciesin.columbia.edu/gpw/

[25] The Internal Distance is defined as the geographic distance between consumers and producer of a country. Foreign Market Potential (FMP) states that the spatial proximity (or remoteness) to rich countries exerts a positive (or negative) impact on the market potential. For more details see the definition of variables in Appendix 1.1.

observed between Foreign Market Potential (FMP) and primacy. This means that countries that are located closer to strong foreign markets tend to present lower primacy.

To better explain these observations we will use a set of countries divided in three groups (see Table 1.28), where we consider the countries' Zipf's parameter (in parenthesis) and the combination of four types of variables: economic (GDP per capita), institutional (quality of institutions captured by the Polity index[26]), geographic (geographic distance or land size) and geo-economic (FMP).

Table 1.28. Spatial variables and urban structures

Group (a)		Institutions -	
		Distance -	Distance +
GDP cap -	FMP +	...	...
	FMP -	Rwanda (0,37)	Congo D.R. (0,65)
GDP cap +	FMP +	...	...
	FMP -	Kuwait (0,55)*	Saudi Arabia (0,80)

Group (b)		Institutions +/-	
		Distance -	Distance +
GDP cap +/-	FMP +	...	Mexico (0,87)
	FMP -	Costa Rica (0,43)*	Brazil (0,9)

Group (c)		Institutions +	
		Distance -	Distance +
GDP cap -	FMP +	...	...
	FMP -	...	...
GDP cap +	FMP +	Netherlands (1,26)	Canada (0,89)
	FMP -	New Zealand (0,78)	USA (1,06)

Legend
( ). parethesis indicate the country's Zipf's parameter
*. indicates primacy rate due to the absence of Zipf's parameter in our dataset
+ . High, good or large
-. Low, bad or small
+/-. Middle
Source: Urban dataset, our elaboration

[26] We use the average of the Polity index - coming from Polity IV dataset - for the years 1960, 1970, 1980, 1990 and 2000. For further details see Appendix 1.1.

Group (a) considers a set of countries that present weak institutions, which can show both low and high GDP per capita and FMP, as well as small or large geographic distances. In this group we do not find countries with a high FMP.

The first case that stands out is Rwanda (low economic level), which present a very high hierarchical urban structure (Zipf's=0,37), which is the result of small internal distance and institutional factors (lack of social cohesion, political instability, and poverty) that impel a massive migration to the capital seeking for security.

A second "type" among this group is Congo D.R., which presents a relevant hierarchical urban structure, in spite of its large geographic distance. This case presents the combination of both political instability and a polarized urban structure; its urban grid does not present a Midsize city network (see Table 1.29). Without Midsize cities and a weak institutional setting the strong agglomerative forces of the main city will grab the population located in cities of lower hierarchy or rural areas, generating a large agglomeration. Indeed Kinshasa is among the top "traumatic jumps" that we have seen before. Moreover, if we do the same exercise for Bangladesh, we will see a similar dynamic in Dhaka.

Table 1.29. Congo's D.R. urban structure (1960 and 2000)

City	Pop 1960	City size 1960	Pop 2000	City size 2000
Kinshasa	451.000	Town	5.064.000	Big
Lubumbashi	194.000	Town	967.000	Small
Mbuji-Mayi	39.000	Town	874.700	Small
Kananga	115.000	Town	521.900	Small
Kisangani	127.000	Town	497.800	Town
Likasi	80.000	Town	364.700	Town
Bukavu	61.000	Town	231.800	Town
Matadi	60.000	Town	219.500	Town
Kikwit	15.000	Town	217.100	Town
(...)	(...)	(...)	(...)	(...)

Source: Urban dataset

Finally, in this group we have two countries with high GDP per capita and weak institutions. Both cases (Kuwait and Saudi Arabia) belong to oil-based economies; in the first case the concentration is very high and in the second its large distance contributes to reduce the hierarchy of the urban structure.

Group (b) contains countries with an institutional quality neither good nor bad and a medium (or improving) level of GDP per capita. In this group is notable the case of Costa Rica which presents a high primacy rate (0.43). The reason is a low FMP but in particular the fact that the process of urbanization has not been well managed; land use regulations and promotion of governmental decentralization remain an open agenda (Meoño, 2009).

The other two cases of this group are bigger countries: Mexico and Brazil. Both present large internal distances, so the geographic dimension contributes to reduce the hierarchical urban structure. Mexico has a slightly lower hierarchy than Brazil; probably its higher FMP, due to the presence of US, contributes to reduce its urban concentration. It is interesting to observe that both countries have a similar urban structure: low hierarchy but large urban agglomerations.

Group (c) collects cases of countries with good institutions and high GDP per capita as well as both, low and high FMP and geographic distances.

In this group, stands out the urban structure "Netherland's type". Given its geographic localization, Netherlands presents the higher FMP in the world, constituting a place with a great combination of disseminated attraction forces and a polycentric urban structure. As a consequence, a reduced geographic distance coexists with a lower urban hierarchy; the presence of an important sea port as Rotterdam, is balanced by its midsize cities network, acting as a link between the main city and the hinterland; hence the urban structure is flexible and strong. Intermediate cities reduce the emergence of high primacy, allowing the control of diseconomies of agglomeration and providing more opportunities for the hinterland.

On the other hand, New Zealand is a case where good institutions and high GDP level do not guarantee a polycentric urban structure (Zipf's 0.78), due to its low FMP.

Finally, in this group we have two similar cases, Canada and USA. Both present good institutions, high GDP per capita. The FMP of Canada (obviously) is higher than USA, but Canada presents a much higher level of ruggedness and worse climate conditions. Consequently, Canada's settlements will tend to be more concentrated than in USA. However the large extension of both countries, as well as their quality of institutions and high economic development, allow them to have low hierarchical urban structure where large agglomeration coexist with a rich variety of cities sizes.

1.5.3. Main Features of the Urban Structure:

After analyzing the different spatial variables that affect agglomeration patterns, now we will consider some basic characteristics of the global urbanization processes and structure. In Table 1.30, we present a synthesis of basic indicators that capture the urban structure, in which we classify countries by the size of their population and level of income. Countries are classified in three ranges according to the size of population: "small" (less than 10 million habitants); "middle" (more than 10 million habitants, but less than 70 million) and "large" (more than 70 million). The level of income corresponds to the classification of the World Bank. For each group the averages of the urbanization level (share of urban population), the primacy level (non-weighted average of the primacy level of the countries that are in the group), and the average value of the Zipf's parameter (weighted average for countries belonging to the group), have been calculated.

Table 1.30. Averages of global urban structure by country's income level and population size

a) Urbanization levels (average)

Country Income level	Small	Medium	Large
High	0,80	0,76	0,76
Middle	0,51	0,50	0,44
Low	0,42	0,44	0,52

Country size (population)

b) Primacy levels (average)

Country Income level	Small	Medium	Large
High	0,36	0,19	0,19
Middle	0,45	0,27	0,18
Low	0,40	0,24	0,06

Country size (population)

c) Zipf's (averages)

Country Income level	Small	Medium	Large
High	0,75	0,87	0,90
Middle	0,57	0,75	0,88
Low	0,72	0,82	1,34

Country size (population)

Source: Data comes from Kim (2007), our elaboration

From this table indicate some as general features of the urban structure can be indicated:

a) As has been mentioned before, income level and urbanization are generally linked; additionally, we do not observe indications that the urbanization level is affected by the population size.

b) In average, we observe that higher primacy rates are more present in countries with less population (less population and less land size can be linked); the primate city exerts more attraction in a country with less population, where it is less probable that other large urban centers will arise. Additionally, we do no observe a clear pattern between income level and primacy rates.

c) We observe that large countries tend to present less hierarchical urban structures, which can be an indication that larger countries (also in size) face large distances that reduce the hierarchical level. Finally, with this type of indicators it is difficult to observe links between urban structure and income level, issue that requires further analysis.

To deepen our analysis, we present some regressions of the urban structure (captured by the Zipf's parameter) on geo-economic variables (see Table 1.31).

Regression (1) shows that countries with higher income tend to present less hierarchy, as well as those with large land. However, when we consider other spatial variables, the effect GDP per capita becomes not significant; hence we have not considered it in the other regressions.

Regression (2), (3) and (4) show that Internal distance (INT_dist), Foreign Market Potential (FMP) and level of openness (trade on GDP) play a role in explaining the level of hierarchy. In this sense, the results of the previous descriptive analysis are confirmed.

Higher internal distances (consequently larger land areas) contribute to reduce hierarchical urban structures, as well as the presence of other attractive markets outside the main national city. Higher FMP[27] multiplies the location opportunities for industries and labor, which diminishes hierarchy. Additionally, trade (or openness), contributes in reducing primacy, as Krugman and Livas (1992) indicate.

Finally, analyzing regional dummies, we observe that the coefficient for Africa and Latin American countries are negative and either significant (the case of Africa) or close to statistical significance (Latin America). In both cases there are forces (institutional and social) that push upwards a more hierarchical urban structure.

[27] If we would apply this analysis only to Western Europe, the FMP variable will become stronger.

Table 1.31. Zipf's parameter and geo-economic variables[28]

Dependent variable Zipf'sw parameter	(1)	(2)	(3)	(4)
Constant	-0,455	-1,246	-1,420	-1,184
	(-1,913)	(-3,375)	(-3,649)	(-2,363)
ln(pcGDP_00)	,057			
	(3,237)			
ln(INT_dist)		,178		,157
		(5,963)		(5,682)
Ln (FMP_00)		,066	,066	,083
		(3,196)	(3,196)	(2,839)
% Trade GDP_00		,002	,002	
		(2,927)	(2,785)	
ln(Land)	0,059		,089	
	(4,380)		(6,160)	
Dummy LAC				-0,135
				(-1,944)
Dummy AFR				-0,142
				(-2,158)
Dummy ASI&ME				0,021
				(,335)
Dummy WEU				-0,099
				(-1,296)
	97	96	96	97
Adjusted R square	0,206	0,297	0,297	0,316

t statistics in parenthesis

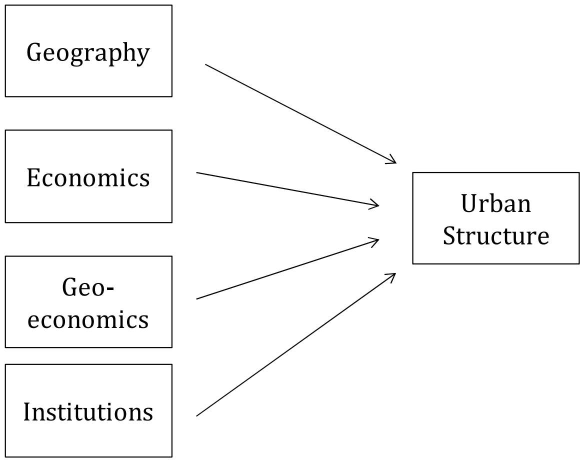
Source:Urban dataset, our elaboration

1.6. Urban Structure and Deep Determinants of Growth

As we have analyzed, the urban structure is an endogenous factor, configured by economic, geographic, geo-economic and institutional elements. Its configuration could be synthesized as Figure 1.13. describes.

[28] Due to the way in which the variable Internal distance has been constructed, IT is possible the presence of an auto-correlation with the Zipf's parameter, reason why in regression (2) we change this variable by Land, the results are not so different.

Figure 1.13. Urban structure an as endogenous factor



Source: Our elaboration.

In Figure 1.14, many of the elements that affect the urban structure coincide with the so called "deep determinants of growth" (Rodrick *et. al.* , 2004).

Rodrick considers the existence of "deep" and "proximates" determinants of economic growth. Among the first ones we can find geographic factors, the economic integration and the role of institutions; the second ones are mainly physical capital and human capital (which in Rodrick's approach depends on the previous determinants).

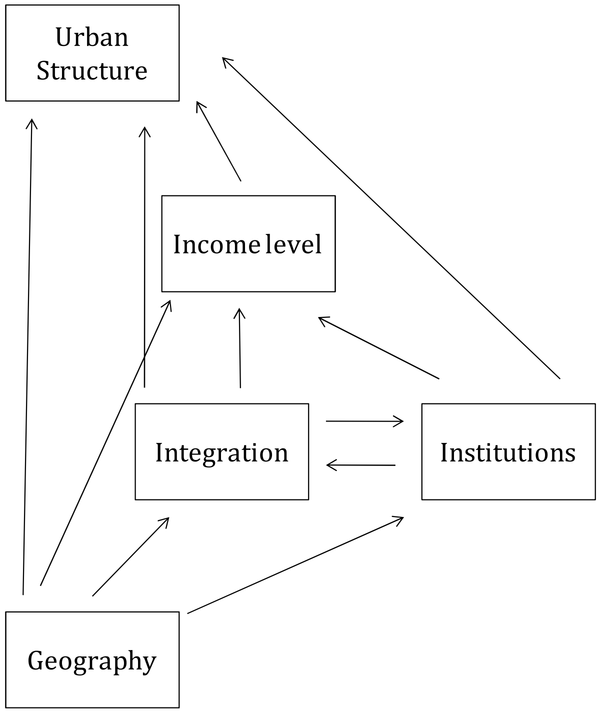
Therefore we can include the effect of these determinants on the urban structure, using the same framework of Rodrick *et. al.* (2004), see Figure 1.14. This analysis allows us to link the determinants of growth with the urban structure.

As it can be observed, the "deep determinants" have both a direct and indirect effect on the urban structure and this is – in short- the result of our previous analysis.

Nevertheless, the urban structure could become in the long run an additional determinant in the process of economic growth, due to the fact that most economic activities take place in cities.

> "Aggregate economic activity is primarily *urban* economic activity (…) cities arise endogenously out of a trade-off between agglomeration forces and congestion costs. It is the size distribution of cities itself, and it is evolution through the birth, growth, and death of cities, which leads to a reconciliation between increasing returns at the local level and constant returns at the aggregate level."(Rossi-Hansberg and Wright, 2007:597, 615)

Figure 1.14. Deep determinants of growth and an endogenous urban structure



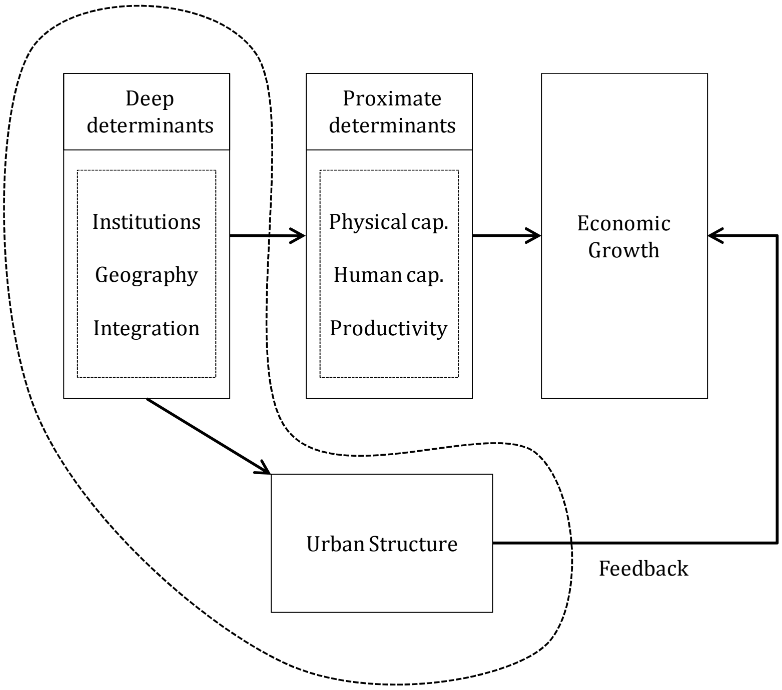
Source: Rodrik et. al. (2004) with modifications.

In other words, it is feasible to think that the urban structure could, at the same time, produce a feedback effect on economic growth. This means that the urban structure, once configured, is a “long-run” characteristic that influences development, positively or negatively, depending on the presence of non-performing or performing urbanization processes.

The attempt to verify this hypothesis is interesting because, as we have mentioned previously, currently there exists a debate on the type of urban structure (concentrated or diffuse) that fits better with economic development. Implicitly, this means to consider the existence of a feedback effect of the urban structure as a catalyst for economic growth.

In this sense, we can draw that relation between the determinant of growth, urban structure and economic development in the following way (see. Figure 1.15), where the urban structure could be seen as a further “deep determinant” of growth.

Figure 1.15. Urban structure as endogenous and exogenous factor for growth



Source: Based on Rodrick (2002) and Rodrick et. al. 2004); our elaboration.

It is important to indicate that there are very few empirical studies in which the existence of this link is analyzed. Kim (2007) carried out a study using some indicators of urban structure such as: urban population, Zipf's parameter, primacy, secondary ratio of primacy (population of the second largest city over population of the largest city), among others. His estimation strategy can be summarized in the following way:

$$Y_i = f\left(U_{it-1}, I_{it-1}, M_{it-1}, C_{it-1}\right)$$

Where, Y_i indicates the level of GDP per capita in 1995 or growth rate of GDP per capita between 1991 and 1995, U represents a vector of urban structural variables, I captures institutional variables, M the share of manufacturing in GDP and C countries commuting costs.

However, Kim does not find any significant effect of the urban structure on growth.

A weakness of his study is the short period of time considered (1991-1995), while the effects of the urban structure surely require observations in wider periods of time. In this sense, we consider relevant to explore the relation of the urban structure and its possible effect on economic development, issue that will be considered in Chapter 3.

1.7. Main Conclusions and Questions

The previous analysis gives us different suggestions about the urban transformation of the last years. In general, we observe a convergence pattern in the process of urbanization; in other words, those countries that have more urban population present lower rates of urban population growth (phenomenon related also to economic convergence), as we have seen in Table 1.8.

This is a symptom of the existence of a relationship between industrialization and urbanization. The process of transformation from an agricultural based economy into an industrial one, impulses urban growth according of the demand of the manufacturing and service sector. When a country's economic development reaches its maturity, the urbanization growth rates slow down. In this context, there exist different possible levels of urbanization according to the country's characteristics (population and resources).

Additionally, as it has been shown, the urban structure is clearly an endogenous element shaped by institutional, economic, geographic and geo-economic factors. The interactions between theses factors give raise to different forms of urban structures, which could be concentrated, disperse or a mix of both.

These different urban structures are linked to two urbanization processes. The first one, which we denominate performing urbanism, is the process where urbanization walks together with the productive transformation of the country. The second one, "non-performing urbanism" (also known as hyper-urbanization), is the process where the institutional weaknesses are reflected in the concentration of power and the hinterland is left out the influence of legal institutions. This phenomenon of power concentration impels the population growth in the main city, with the counter-effect on weak midsize cities, creating enormous negative pecuniary externalities that bring serious problems such as slums.

A deeper analysis about the factors that affect the levels of hierarchy give us interesting elements. The first and "classic" one is the role of distances on urban structure. Countries that show larger internal distances – which implies larger land- present less hierarchical urban structures. It indicates that long distances and the related transport costs work as barriers to agglomeration.

The second element that plays a significant role in the level of hierarchy is the Foreign Market Potential (FMP), which means that being in the middle of areas with a relevant market potential offers the possibility of localization beyond the main city of the country, reducing primacy. Additionally, FMP tends to be lower among countries of larger size; states that cover a bigger surface tend to have fewer opportunities to interact easily with other dynamic economic areas.

Another symptom is given by the change in the correlation between the share of agriculture in GDP and primacy in 1960. This correlation was first negative and then positive: also countries that have not transformed their economic structure, today can show high levels of primacy which, we think, is a clear example of processes of non-performing urbanism.

This situation becomes even worse in the presence of low social cohesion, inequality, warfare, or very deep institutional weakness, where processes of catastrophic agglomeration and traumatic jumps can be verified.

The correlations of primacy and urbanization level (Table 1.24) seem to confirm these observations. The shares of urban and non urban population are not correlated with primacy; moreover the correlation between primacy and GDP per capita (Table 1.25) is negative and significant, and the correlation between Gini coefficient and primacy is positive and significant.

Growing urbanization has slightly affected the stability of the Zipf's coefficient in the last forty years (Table 1.19). We observe a very small decline in the index (higher hierarchy) due to changes at the top and bottom of the cities size distribution; changes occurred in the "first frontier of urbanism" (Towns and Small cities) and among Big and Mega cities. The hierarchy level among Midsize cities is instead very stable.

Consequently, from our analysis two main issues emerge that we will analyze in Chapter 3. The first one regards the presence of non-performing urbanism in the evolution of large agglomerations. Today it is feasible to observe countries that besides their large geographic extension and low industrialization level, host giant cities. This fact indicates that other elements, beyond the economic ones, are playing a key role in shaping agglomerations, in particular among big and mega cities.

This is why we will analyze the cities according to their sizes, with the aim to understand the underlying factors of their dynamic growth: we want to see if there are different drivers in growth of large agglomerations (Mega and Big cities) Midsize cities and Small ones; this analysis can contribute to observe when and where there is a presence of non-performing urbanism.

Finally, we intend to analyze if the urban structure can be considered as a long run character, which becomes a "deep determinant" of economic growth. In other words, if "performing urbanism" (a good urban structure) can be considered an important element in further economic growth processes.

Before affording these issues, it is necessary to review the literature of urban studies that would permit us to understand in a better way the complexity of urban development processes. This aspect will be analyzed in the next chapter.

Appendix 1.1.

Description of the Urban dataset

Introduction

Our "Urban dataset" includes most of the variables that have been considered in previous empirical studies on cities sizes[29]; new variables have been also added. Appendix 1.1 is organized in four parts. Part 1 presents a short overview of the different datasets that have been selected. Part 2 analyzes in detail the content of each dataset. Part 3 indicates the definition of variables. Part 4 shows the list of countries covered by our dataset. Part 5 presents in more detail the structure of the spreadsheet.

1. Dataset of datasets: An overview

Our data set considers a period of 40 years (1960-2000) including 1,919 cities located in 134 countries. It has been constructed using 14 different datasets, organized in five groups of variables: demographic, economic, geo-economic, geographic and historical-institutional. Table A.1 shows the different datasets that have been used in building our research's dataset.

Demographic data comes from *World's Cities dataset* of Henderson (2002), which contains population data from 2,847 cities. This dataset has been codified for the research's purposes according to five categories of cities sizes used by United Nations. Code 1 refers to Mega cities (+10 mill. people), Code 2: Big Cities (5-10 mill.), Code 3: Midsize Cities (1.5-5 mill.), Code 4: Small Cities (0.5-1.5 mill.) and Code 5: Towns with less than 0.5 mill. This dataset has been modified to have the same observations from 1960 to 2000 remaining 1,919 cities. All the cities that we dropped belong to category 5 (Towns), most from China which presents a lot of new entrance in the recent records. Other demographic variables, such as urban and non urban population come from *World Bank Data Catalog*. Demographic data includes a language diversity indicator, which comes from the *Ethnologue Encyclopedia 16th Edition* (Lewis ed., 2009) available for 227countries. We call this Language Diversity dataset.

[29] For further detail of the studies that has been analyzed see Chapter 2 and our bibliographic references.

Table A.1.1. Sources of research's dataset

Author/year	Type of variables	Dataset
Henderson (2002)	Demographic	World's Cities
Ethnologue Encyclopedia 16th Edition. M. Paul Lewis (ed.), (2009)	Demographic	Language Diversity
World Bank	Economic / Demographic	World Bank Data Catalog
LABORSTAT - International Labour Organization	Economic	LABORSTAT
Angus Maddison (2010)	Economic	Historial Statistics of Maddison
Deininger and Squire (1996)	Economic	Deininger and Squire
Schneider, Buehn and Montenegro (2010)	Economic	Schneider
Centre D'Etudes Prospectives et D'Informations Internationales (CEPII)	Geo-economic	Geo-cepii
Centre D'Etudes Prospectives et D'Informations Internationales (CEPII)	Geo-economic	Dist-cepii
Centre D'Etudes Prospectives et D'Informations Internationales (CEPII)	Geo-economic	Rmp-cepii
Canning and Farahani (2007)	Geo-economic	A Database of World Stocks of Infrastructure
Kim Dongsoo (2007)	Geo-economic	Zipf's parameters
Nunn and Puga (2010)	Geographic / Historical-institutional	Rugged
Polity IV Project (2010)	Historical-institutional	Polity IV

Economic variables such as Openness, Agriculture or Industry Value Added come from *World Bank Data Catalog*. Unemployment rates and Economic Active Population come from *LABORSTAT dataset*, statistical database from the International Labour Organization-ILO. Data of GDP and GDP per capita has been taken from the *Historical Statistics of Maddison* (2010). Size of shadow economy comes from *Schneider, Buehn and Montenegro* (2010); we call this Schneider dataset, which contains data from 162 countries for the years 1999 to 2007. Finally, we include an indicator of inequality, using the Gini index from *Deininger and Squire dataset* (1996) available for 138 countries from 1960 to 1997.

Geo-economic variables have been included. Internal Distances within consumers and producer of a country comes from *Geo cepii dataset* of the Centre D'Etudes Prospectives et D'Informations Internationales (CEPII). Average of Bilateral Geodesic Distances between main cities, comes from *Dist cepii dataset* of CEPII; for both datasets data are for 225 countries. Real Market Potential and Foreign Market Potential come from *Rmp cepii dataset* of CEPII; data are available for 225 countries from 1960 to 2003. Indicators on stock of transport infrastructure come from *A Database of World Stocks of Infrastructure* from Canning and Farahani (2007). It is an updated version of Canning (1998). Data are available for 185 countries from 1950 to 2005. Finally, it has been also included a dataset of Kim

(2007) which includes the Zipf's exponential power parameter for 99 countries for the year 1995.For further details on geo-economic indicators see below (section 3.) the definition of variables

Geographic data such as land area and landlocked dummies come from *Geo cepii dataset*. Measurement of desert areas, tropical climate covering the territory, distances for the nearest free-ice cost, ruggedness index and dummy variables on the continent in which cities are located, come from Nunn and Puga (2010) who built the *Rugged dataset* available for 234 countries. Agricultural land data (1960-2000) come form *World Bank Data Catalog*.

Historical-institutional data include two groups of indicators. Dummy variables on colonial origin (Spanish, British, etc.) and legal systems (Civil law, Common law, etc) come from *Rugged dataset*. Political regime (democracy-autocracy) and the characteristic of the recruitment of political executives (regulated of unregulated) come from *Polity IV dataset* (Polity IV Project, 2010). Data are available for 188 countries from 1,800 to 2,009.

2. Dataset contents

2.1. Demographic variables

City population data: Data come from *World's Cities dataset*. It contains population data of 2,847 cities in 149 countries. The definition of city used by Henderson corresponds to the definition of "urban agglomeration". The dataset contains city population for five years (1960; 1970; 1980; 1990 and 2000). For some years data were not available. In these cases, Henderson use available data in a range of 5 years before or after the selected five years of the dataset. To build the dataset, Henderson used different sources, such as national institutions, World Gazetteer and particularly World Urban Prospects of UN, among others. Nonetheless, the dataset present some missing values. As result we have observation of 1,925 cities located in 129 countries.

Population, density, urban and non-urban population: Data of country's population, urban and non urban population comes from the *World Bank Data Catalog*. Data of country's area (km square) comes from *Geo cepiis dataset*.

Language diversity data: The dataset comes from the *Ethnologue Encyclopedia 16th Edition* (SIL International. Online version: http://www.ethnologue.com/) this contains data of 6,909 known living languages of the world. To capture the level of idiomatic complexities, we use the Language Diversity Index available for 227 countries. The highest possible value of the index is 1 (total diversity) and the lowest 0 (no diversity). Further details; see below the definition of variables.

2.2. Economic variables

GDP and GDP per capita data: Data set comes from the *Historical Statistics of Maddison*. (Statistics on World Population, GDP and Per Capital GDP, 1-2008 AD). The information is available for all world countries for a long period of time and permits to have all the data for the period considered in our research (1960-2000). For inter-country GDP comparisons Maddison use purchasing power parities (PPPs) measures taken 1990 as the benchmark year.

Inequality data: The data comes from *Deininger and Squire* available for 149 countries from 1960 to 1997. Inequality is measured using the Gini Index, presented in a scale from 0 to 100.

Trade (openness) data: Data comes from the *World Bank Data Catalog*. The indicator of openness is measured as the percentage of trade (exports + imports) on GDP. Data is available for a set of 228 countries from 1960 to 2008.

Agricultural and industrial value added data: Data comes from the *World Bank Data Catalog*. We consider indicators of agriculture and industrial value added as percentage of GDP. That is available for most worlds' countries and for the period assessed by the research. Data is available for a set of 228 countries from 1960 to 2008.

Economic active population data: Data comes from *LABORSTA database* of International Labour Organization. Data is available from 1969 up to date, available for 222 countries.

Unemployment data: Data comes from *LABORSTA database* of International Labour Organization. Data of unemployment rates is available from 1969 up to date, available for 222 countries.

Shadow economy data: Data comes from *Schneider dataset*. Data are available for 162 countries from 1999 to 2007. The shadow economy is measure as a percentage of national GDP. For further details on the definition of shadow economy, see below the definition of variables.

2.3. Geo-economic variables

Internal distances data: Data comes from *Geo-cepii dataset*. Internal distance of country measures the distance between produces and consumers in a country (see Head and Mayer, 2002). It contains data for 225 countries. For further details see below the definition of variables.

Geodesic distance between main cities: Data comes from the *Dist-cepii dataset*. Our dataset presents the average bilateral distance between the main city of each country with all the world's main cities. As example, the average distance between Germany's main city and all world's main cities is 9,893 km, meanwhile in the case of Japan's is 36,065 km. For further details see the definition of variables below.

Real Market Potential and Foreign Market Potential data: Data comes from *Rmp-cepii dataset*. CePII's. These indicators proxy firm's location choices, because consider the demand of producers in a certain location weighted by transport costs. The dataset contains measurements for 205 countries (in some cases 152) for 44 years. For further details see the definition of variables below.

Zipf's exponential power parameter: Data comes from *Zipf's Parameter Table,* Kim (2007). This indicator captures the hierarchical level of the urban structure. The Zipf's parameter is calculated using UN dataset with information of 3,150 cities. The Table offers OLS estimates and weighted least squares (WLS). WLS considers "city population as the weight, making larger cities more influential than smaller cities" Kim (2007:47); this means that in countries where a mega city dominates, the Zipf's parameter is lower than the one calculated using OLS. A lower parameter indicates higher hierarchy; the expected value is equal to 1 (also called it rank size rule). The Table contains information of 99 countries for the year 1995. For our dataset we consider WLS values. For further details see the definition of variables below.

Paved roads data: Although roads infrastructure is not a specific geo-economic variable, their presence has a relevant impact in spatial economic analysis. For this reason we have included this variable in the group of eco-economic variables. Length (km) of Paved Roads comes from *A Database of World Stocks of Infrastructure***.** It contains data from 1960 to 2002 for 186 countries. Our dataset also presents this variable weighted on country's area.

2.4. Geographic variables

Land area: Data comes from *Geo-cepii dataset*. It contains land area (km square) for 225 countries including overseas territories.

Agricultural land area: Data comes from *World Bank Data Catalog*. It indicates agricultural land in square kilometers. The dataset contain data for set of 228 countries from 1960 to 2008.

Desert area: Data comes from *Rugged dataset*. It considers share of the country's desert area on total country's area. Data are available for 234 countries.

Tropical climate area: Data comes from *Rugged dataset*. It considers the share of the country's tropical climate area on total country's area. Data are available for 234 countries.

Ruggedness data: Data comes from *Rugged dataset*. It considers the Ruggedness Terrain Index to quantify topographic heterogeneity. Data are available for 234 countries. For further details see the definition of variables below.

Country landlocked data*:* Data comes from the *Geo-cepii dataset* and from *Rugged dataset*. To measure landlocked level of a country, the dataset includes three different indicators, differentiated by the level of accuracy. The most general is a dummy variable (1: landlocked and 0: unlocked). A second variable considers the distance to the nearest ice-free coast within 1000 km (distant coast). The third variable includes the percentage of the land of each country that is within 100km of the nearest ice-free coast (near coast). For further details see the definition of variables below.

Geographic region: Data comes from the *Geo-cepii dataset*. It includes dummy variables indicating in which geographic region a city is located. The geographic regions are: South America, Africa, Europe, North America, Oceania and Asia.

Railway data: Although railway infrastructure is not a specific geographic variable, their presence has a relevant impact in spatial mobility; hence it can be considered a human geographic factor. For this reason we have included this variable in the group of geographic variables. Length (km)of Rail Lines comes from *A Database of World Stocks of Infrastructure*. It contains data from 1950 to 2005 for 175 countries. Our dataset also presents this variable weighted on country's area.

2.5. Historical-institutional variables

Legal system: The legal system consists in written and oral legislations of a country. Although each country shapes and is shaped by a particular law system, this is embodied within a general type of system, such as Civil or Common law. Using dummy variables, our dataset identify five types of legal systems (Common law; French civil law: Socialist law; German civil law and Scandinavian law). Data comes from *Rugged dataset*. Data are available for 234 countries

Colonial origin: Dummy variables are used to identify the colonial origin: Spanish, British, French, Portuguese and Other European. Data comes from *Rugged dataset*. Data are available for 234 countries.

Political regime data: Data comes from *Polity IV dataset*. Data is available from 1800 to 2009 for 188 countries. Four indicators have been included: Autocracy (authoritarian regime), Democracy, Composite Political Regime (combine the scores of both: autocracy and democracy) and Executive Recruitment or the way on which authorities arrived to power. For further details see the definition of variables below.

3. Definition of variables

For practical reasons we present definitions only for those indicators that in our criteria required a clarification.

City*:* The definition of city used in the data set corresponds to the definition of "urban agglomeration" of UN Word Urban Prospects (WUP). Urban agglomeration "refers to the de facto population contained within the contours of a contiguous territory inhabited at urban density levels without regard to administrative boundaries. It usually incorporates the population in a city or town plus that in the sub-urban areas lying outside of but being adjacent to the city boundaries." This is similar with the generic definition of city as "metropolitan area" which, according WUP definition, "includes both, the contiguous territory inhabited at urban levels of residential density and additional surrounding areas of lower settlement density that are also under the direct influence of the city (e.g., through frequent transport, road linkages, commuting facilities etc.)."

Shadow economy: The definition of shadow economy used in the dataset, indicates that "the shadow economy includes all market-based legal production of goods and services that are deliberately concealed from public authorities for any of the following reasons: (1) to avoid payment of income, value added or other taxes, (2) to avoid payment of social security contributions, (3) to avoid having to meet certain legal labor market standards, such as minimum wages, maximum working hours, safety standards, etc., and (4) to avoid complying with certain administrative procedures"(Schneider et. al., 2010:5). This definition does not include illegal activities.

Language diversity index: The *Language diversity dataset* use Greenberg's "language diversity index", calculated by the following formula:

$$di = 1 - \sum (Pi)^2$$

Where *Pi* represents the percentage of the total population which constitute the *i* language group; *i* goes from1 to all the languages that constitute a particular society. When the population is totally homogeneous P tends to l, becoming the diversity index close to zero..As example Papua New Guinea present the highest language diversity index (0.990) meanwhile Cuba presents the lowest (0.001).

Internal distances: For this indicator we consider the literature on area-based measures (Head and Mayer, 2002). The assumptions made by Head and Mayer are the following: the area is a circle and is internally homogeneous; consumers are uniformly distributed in it. Weighting the different regions (cities) according Zip's law, they obtain an average distance between two points of the country (or region) equal to 2/3 of the radius. So, the "internal distance" is calculated by the following formula:

$d_{ii} = 0,67\sqrt{\frac{Area}{\pi}}$ The country's area is calculated in square kilometers.

Geodesic distance between main cities: Geodesic distance[30] is calculated in the following way:

D*i* is the average distance from main city of country "i" and main cities of all other countries in the world (suffix "j");d_{ij} is the distance between main city in country *i* and main city in country *j*. N is the number of countries. So the average distance is calculated as follows:

$$D_i = \frac{\left(\sum_{j \neq i} d_{ij}\right)}{(N-1)}$$

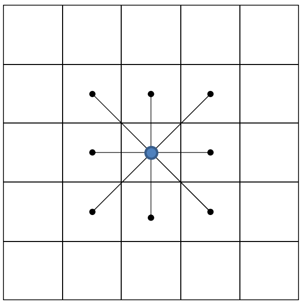
As we can see, our indicator of geodesic distance is different from the one used by Mayer and Zignago (2006), in two points: they use an average distance not between main cities but between different cities in each country; and, secondly, they weight distances by the population percentage of each city in the country. Their formula is the following:

$$dij = \left(\sum_{k \in i} (\text{pop}_k \,/\, \text{pop}_i) \sum\nolimits_{l \in j} (\text{pop}_l \,/\, \text{pop}_j) d_{kl}^{\theta}\right)^{1/\theta}$$

where pop $_k$ designates the population of agglomeration *k* belonging to country *i* and the parameter θ measures the sensitivity of trade flows to bilateral distance $d_{k\ell}$.

[30] Geodesic distances are the shortest distances between two points on the surface of a sphere.

Ruggedness Terrain Index: "Rugged terrain is tough to farm, costly to traverse, and often inhospitable to live in" (Nunn and Puga, 2010:1).



It captures topographic heterogeneity measured in hundreds of meters of elevation difference for a point and the contiguous 8 points (see figure) in a grid map where each point is at a distance of 30 arc-seconds (926 meters on a meridian) from any other point. The data come from GTOPO30 (US Geological Survey, 1996). That has regularly mapped the entire surface of the Earth in points regularly spaced every 30-arc-seconds. The terrain ruggedness index at the central point of the figure is given by the square root of the sum of the squared differences in elevation between the central point and the eight adjacent points. For further details see: Nunn and Puga (2010:2,4).

Real Market potential and Foreign Market Potential: We use two market potential indicators as defined in Mayer (2008): Real Market Potential (RMP) and Foreign Market Potential (FMP). The real market potential RMP is given by a function that measures income per capita of the country, the easiness of access to its market and its ability to compete in foreign markets. A problem with RMP is that it contains the own income of the country it refers to, causing an evident endogeneity problem. A solution that has been proposed by the literature is to use the FMP which does not include own demand of the country.

Foreign Market Potential (FMP) states that the spatial proximity (or remoteness) to rich countries exerts a positive (or negative) impact on the market potential of a country and therefore its income. As example: "Belgium and the Netherlands are the two top market potential countries in terms of FMP (...). Opposed to the case of those countries are the United States and Japan. These two countries are among top RMP economies, but not among big countries with a strong FMP because demand comes almost entirely from their internal demand.

Average distance to the nearest ice-free coast within 1000 km (distant coast):

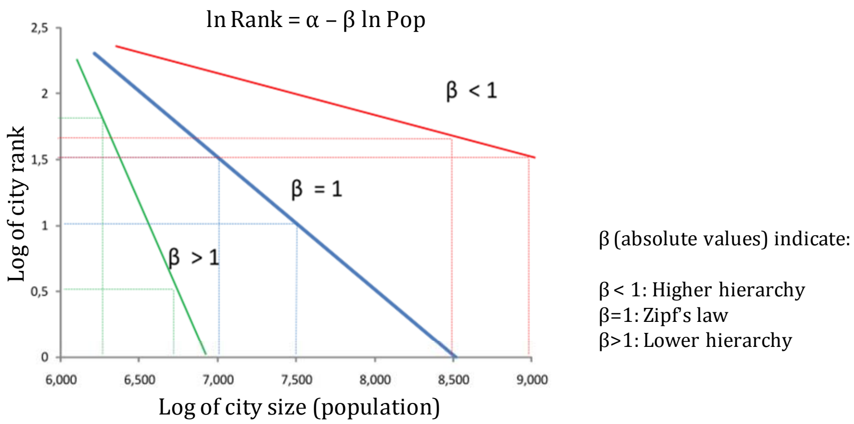
"To calculate the average distance to the closest ice-free coast in each country, we first compute the distance to the nearest ice-free coast for every point in the country in equi-rectangular projection [which converts the world map in a flat Cartesian grid, where each rectangular cell has the same area] with standard parallels at 30 degrees (…). We then average this distance across all land in each country not covered by inland water features. Units are thousands of kilometers." (Nunn and Puga, 2010: Notes - *Rugness dataset*)

Percentage within 100km of the nearest ice-free coast (near coast): "On the basis of the same data used to calculate the average distance to nearest ice-free coast, we calculate the percentage of the land surface area of each country that is within 100km of the nearest ice-free coast." (Nunn and Puga, 2010: Notes - *Rugness dataset*).

Primacy rate: Country's main city (most populated city) on total country's urban population.

Primacy 2: Country's main city over the population of the second and third largest city.

Zipf's exponential power parameter: Zipf's (1,949) indicates that the hierarchical distribution of cities of corresponds to a parameter of 1. It implies that the city size distribution should follow the next relationship: lnRank = α- β lnPop ; given Rank the ranking of the cities (from 1 to n) according their size and Pop the population of the cities. It implies that the population in the second city is half of the primate, the third city, a third of the primate, and so on (Rosen and Resnick, 1980; Gabaix and Ionnides, 2003). For further details see the figure below:



Political regime: *Polity IV dataset* captures the indicator the type of political regime of 188 through a combine indicator called "combine polity score" or Polity, which combine the degree of democracy and autocracy of the country. Democracy indicates the quality of institutions through which citizen express their preferences as well as institutional constrains in the exercise of power by the executive and guarantees of civil liberties. This indicator goes from 0 (min.) to 10 (max).

On the other hand Autocracy indicates an authoritarian regime "whose common properties are a lack of regularized political competition and concern for political freedoms (…) autocracies sharply restrict or suppress competitive political participation. Their chief executives are chosen in a regularized process of selection within the political elite, and once in office they exercise power with few institutional constraints. Most modern autocracies also exercise a high degree of directiveness over social and economic activity" (Polity IV Project, Dataset Users' Manual, 2010: 16). This indicator goes from 0 (min.) to 10 (max).

Finally, the combine indicator "Polity" is calculated subtracting the autocracy score from the democracy score, resulting unified indicator which goes from -10 (strongly autocratic)to +10 (strongly democratic). For regression purposes this indicator will be adequate to avoid the presence of negative indicators in a scale from 0 (strongly autocratic) to 20 (strongly democratic).

Executive recruitment: According Polity IV quoting Eckstein and Gurr (1975), this indicator "involves the ways in which super ordinates come to occupy their position". This indicator involves three categories: (1) Unregulated, where "chief executives occur through forceful seizures of power (2) Designational/Transitional, where "chief executives are chosen by designation within the political regime, without formal competition" (3) Regulated, where "chief executives are determined by hereditary succession or in competitive election". This indicator is calculated on a scale from 1 (totally unregulated) to 8 (total regulated). (Polity IV Project, 2010:21)

4. List of countries

Our dataset presents different data from 134 countries. See below (Table A.1.2.) the list of countries (see below)

Table A.1.2. List of countries

1 Afghanisthan
2 Albania
3 Argentina
4 Australia
5 Austria
6 Azerbaijan
7 Bahrain
8 Bangladesh
9 Belarus
10 Belgium
11 Benin
12 Bolivia
13 Bosnia
14 Botswana
15 Brazil
16 Bulgaria
17 Burkina Faso
18 Burundi
19 Cambodia
20 Cameroon
21 Canada
22 Central African Republic
23 Chad
24 Chile
25 China
26 Colombia
27 Congo D.R. (Zaire)
28 Congo Republic
29 Costa Rica
30 Cote I'voire
31 Croatia
32 Cuba
33 Czech
34 Denmark
35 DJbouti
36 Dominican Republic
37 Egypt
38 El Salvador
39 Equador
40 Estonia
41 Ethiopia
42 Fiji
43 Finland
44 France
45 Gambia
46 Germany
47 Ghana
48 Greece
49 Guatemala
50 Guinea
51 Guinea-Bissau
52 Honduras
53 Hong Kong
54 Hungary
55 Iceland
56 India
57 Indonesia
58 Iran
59 Iraq
60 Ireland
61 Israel
62 Italy
63 Jamaica
64 Japan
65 Jordan
66 Kazakstan
67 Kenya
68 Krygzstan
69 Kuwait
70 Latvia
71 Lebanon
72 Lesotho
73 Liberia
74 Lithuania
75 Madagascar
76 Malawi
77 Malaysia
78 Mali
79 Mexico
80 Mongolia
81 Morocco
82 Mozambique
83 Myanmar
84 Namibia
85 Nepal
86 Netherlands
87 New Zealand
88 Nicaragua
89 Niger
90 Nigeria
91 Norway
92 Pakistan
93 Panama
94 Papua New Guinea
95 Paraguay
96 Peru
97 Philippines
98 Poland
99 Portugal
100 Puerto Rico
101 Romania
102 Russia
103 Rwanda
104 Saudi Arabia
105 Senegal
106 Singapore
107 Slovakia
108 Somalia
109 South Africa
110 South Korea
111 Spain
112 Sri Lanka
113 Sudan
114 Sweden
115 Switzerland
116 Syria
117 Tajikistan
118 Tanzania
119 Thailand
120 Tunisia
121 Turkey
122 Turkmenistan
123 Uganda
124 Ukraine
125 United Arab Emirates
126 United Kingdom
127 United States of America
128 Uruguay
129 Uzbekistan
130 Venezuela
131 Vietnam
132 Yemen
133 Zambia
134 Zimbabwe

5. Spreadsheet structure

The dataset presents 1,920 rows and 245 columns, totally 470,400 cells. The numbers of rows correspond to the number of cities considered in the study and the number of columns corresponds to the different variables (demographic, economic, geographic, geo-economic, political and institutional). Columns present data on cities and on other country variables for the years 1960, 1970, 1980, 1990 and 2000.

Table A.1.3 presents a summary of the research's dataset, where regression codes and label of the variables are indicated, as well as the consistency of data in each variable of the dataset.. As example, the variable PopCity_60 (population in each city at 1960) has a consistency of 100%; it means that the dataset contain the city population of 1,919 cities. As it can be observed, the consistency of the dataset is very good due to the fact that 232 of the 245 of the variables have a consistency over 80%.

Table A.1.3. Dataset summary

Regression codes	Label	Consistency of the dataset
C	Country	100%
C_code	Country Code	100%
c_name	City name	100%
Country dummy	Country dummy	100%
city_code	City code	100%
Dummy_cap	Dummy Capital	100%
Dummy_main	Dummy Main city	100%
LN_cityrank_60	Ln city rank according population size 1960 (1 largest, 1919 smallest)	100%
LN_cityrank_00	Ln city rank according population size 2000 (1 largest, 1919 smallest)	100%
LN_PopCity_60	Ln Population in city 1960	100%
LN_PopCity_00	Ln Population in city 2000	100%
G(lnPopCity00_lnPopCity60)	Rate of Growth City Population (Ln Pop City 2000 - Ln Pop City 1960)	100%
LNavg_PopCity60_00	Ln average city population 1960; 1970; 1980; 1990; 2000	100%
PopCity_60	Pop City 1960	100%
PopCity_70	Pop City 1970	100%
PopCity_80	Pop City 1980	100%
PopCity_90	Pop City 1990	100%
PopCity_00	Pop City 2000	100%
size60	Code City Size 1960	100%
size70	Code City Size 1970	100%
size80	Code City Size 1980	100%
size90	Code City Size 1990	100%
size00	Code City Size 2000	100%

SAMEk	City that does not change category between 1960-2000	100%
Ink	City that entered in a new category between 1960-2000	100%
Change	City that changed category between 1960-2000	100%
Jump2cat	Citys that jump 2 or more categories	100%
gruppoG	City dummy for city size 1 and 2	100%
gruppoM	City dummy for city size 3	100%
gruppoS	City dummy for city size 4 and 5	100%
gruppoG60	City dummy for city size 1 and 2 in 1960	100%
gruppoM60	City dummy for city size 3 in 1960	100%
gruppoS60	City dummy for city size 4 and 5 in 1960	100%
PopPrim_60	Population in largest city 1960	100%
PopPrim_70	Population in largest city 1970	100%
PopPrim_80	Population in largest city 1980	100%
PopPrim_90	Population in largest city 1990	100%
PopPrim_00	Population in largest city 2000	100%
Primacy1_60	Primate city ratio 1960	100%
Primacy1_70	Primate city ratio 1970	100%
Primacy1_80	Primate city ratio 1980	100%
Primacy1_90	Primate city ratio 1990	100%
Primacy1_00	Primate city ratio 2000	69%
AvgPrimacy_6000	Average Primacies 1960, 1970, 1980, 1990, 2000	100%
Primacy2_ 1960 (1/2+3)	Primacy 2: Primate city over the sum of the second and thrid largest city	62%
AvgPrimacy2_6000 (1/2+3)	Average Primacy 2 1960, 1970, 1980, 1990, 2000	62%
AvgPrimacy2_6000 (1/2+3+4)	Average Primacy 2 modify (primate city over the sum of secondo, third and fourth city) 1960, 1970, 1980, 1990, 2000	62%
Zipf_70	Zipf's exponential 1970 by Rosen and Resnick	97%
Zipf_95	Zipf's exponential 1995 by Kim	97%
Zipf_95W	Zipf's exponential weighted 1995 by Kim	100%
LN_popurboutmain60	Ln Urban population out of the main city 1960	100%
LN_popurboutmain00	Ln Urban population out of the main city 2000	100%
G(LN_popurboutmain00_LN_popurboutmain60)	Rate of Growth Urban population out main city (Ln Urb. pop out main city 2000 - Ln Urb. pop out main city 1960)	100%
popurboutmain60	Urban population out of the main city 1960	100%
popurboutmain70	Urban population out of the main city 1970	100%
popurboutmain80	Urban population out of the main city 1980	100%
popurboutmain90	Urban population out of the main city 1990	100%
popurboutmain00	Urban population out of the main city 2000	100%
avgpopurboutmain60_00	Average urban population out of main city 1960; 1970; 1980; 1990; 2000	100%
LNavgpopurboutmain60_00	Ln average urban population out of main city 1960; 1970; 1980; 1990; 2000	100%

LN_pop_60	Ln Population, total country 1960	100%
LN_pop_00	Ln Population, total country 2000	100%
G(lnPop00_lnPop60)	Rate of Growth Country Population (Ln country pop 2000 - Ln country pop1960)	100%
pop_60	Population, total country 1960	100%
pop_70	Population, total country 1970	100%
pop_80	Population, total country 1980	100%
pop_90	Population, total country 1990	100%
pop_00	Population, total country 2000	100%
LN_popurb_60	Ln Urban Population 1960 (country)	100%
LN_popurb_00	Ln Urban Population 2000 (country)	100%
LN_avgpopurb_6000	Ln average urban population 1960; 1970; 1980; 1990; 2000	100%
avgpopurb_6000	Average urban population 1960; 1970; 1980; 1990; 2000	100%
G(lnpopurb00_lnpopurb60)	Rate of Growth Urban Population (country) (Ln urb pop 2000 - Ln urb pop1960)	100%
Simple rate Gurbpop6000	Rate of Growth Urban Population (country) (urb pop 2000 - urb pop1960)/urb pop 1960	100%
popurb_60	Urban Population 1960 (country)	100%
popurb_70	Urban Population 1970 (country)	100%
popurb_80	Urban Population 1980 (country)	100%
popurb_90	Urban Population 1990 (country)	100%
popurb_00	Urban Population 2000 (country)	100%
shurb_60	Urban population (% of total) 1960	100%
shurb_70	Urban population (% of total) 1970	100%
shurb_80	Urban population (% of total) 1980	100%
shurb_90	Urban population (% of total) 1990	100%
shurb_00	Urban population (% of total) 2000	100%
LNnonurbp_60	Ln Non Urban Population 1960	100%
LNnonurbp_00	Ln Non Urban population 2000	100%
G(lnNonurbp00/lnNonurbp60)	Rate of Growth Non Urban Population (country) (Ln urb pop 2000 - Ln urb pop1960)	100%
Simple rate Gnonurbpop6000	Rate of Growth Non Urban Population (country) (nonurb pop 2000 - unonrb pop1960)/nonurb pop 1960	100%
nonurbp_60	Non Urban Population 1960	100%
nonurbp_70	Non Urban Population 1970	100%
nonurbp_80	Non Urban Population 1980	100%
nonurbp_90	Non Urban Population 1990	100%
nonurbp_00	Non Urban Population 2000	100%
avgnonurbpop60_00	Average non urban population 1960; 1970; 1980; 1990; 2000	100%
LNavgnonurbpop60_00	Ln average non urban population 1960; 1970; 1980; 1990; 2000	100%
shnonurp_60	Non Urban population (% of total) 1960	100%
shnonurp_00	Non Urban population (% of total) 2000	100%
Dens_p60	Pop Density (people per sq.km) 1960	100%
Dens_p70	Pop Density (people per sq.km) 1970	100%
Dens_p80	Pop Density (people per sq.km) 1980	100%

Dens_p90	Pop Density (people per sq.km) 1990	100%
Dens_p00	Pop Density (people per sq.km) 2000	100%
LDI	Language Diversity Index	95%
LN_GDP60	Ln Gross Domestic Product 1960 (ppp) gear-kamis dollars	99%
LN_GDP00	Ln Gross Domestic Product 2000 (ppp) gear-kamis dollars	95%
G(LnGDP00_LnGDP60)	Rate of Growth GDP 1960 - 2000	95%
Simple rate Ggdp6000	Rate of Growth GDP 1960-2000 (GDP2000 - GDP1960)/GDP1960	95%
GDP_60	GDP 1960 Million 1990 International Gear-khamis dollars	99%
GDP_70	GDP 1970 Million 1990 International Gear-khamis dollars	90%
GDP_80	GDP 1980 Million 1990 International Gear-khamis dollars	99%
GDP_90	GDP 1990 Million 1990 International Gear-khamis dollars	99%
GDP_00	GDP 2000 Million 1990 International Gear-khamis dollars	95%
LNpcGDP_60	Ln GDP per Capita 1960	99%
LNpcGDP_00	Ln GDP per Capita 2000	95%
G(LNpcGDP00_LNpcGDP60)	Rate of Growth GDP per capita 1960 - 2000	95%
LN2pcGDP_60	Ln Square GDP per Capita 1960	95%
Simple rate GpcGDP6000	Rate of Growth GDP per Cap. 1960-2000 (GDP per cap2000 - GDP per cap1960)/GDP per cap1960	95%
pcGDP_60	GDP per Capita 1960 (1990 International Gear-khamis dollars)	90%
pcGDP_70	GDP per Capita 1970 (1990 International Gear-khamis dollars)	95%
pcGDP_80	GDP per Capita 1980 (1990 International Gear-khamis dollars)	99%
pcGDP_90	GDP per Capita 1990 (1990 International Gear-khamis dollars)	99%
pcGDP_00	GDP per Capita 2000 (1990 International Gear-khamis dollars)	99%
Tertile_pcGDP00	Tertiles GDP per Capita 2000 (1 highest and 3 lowest)	99%
Low income_00	Dummy low income GDP per Capita 2000	99%
Middle income_00	Dummy middle income GDP per Capita 2001	99%
High income_00	Dummy high income GDP per Capita 2002	99%
avgpcGDP60_00	Average GDP per capita 1960; 1970; 1980; 1990; 2000	99%
LNavgpcGDP60_00	Ln Average GDP per capita 1960; 1970; 1980; 1990; 2000	99%
LN2avgpcGDP_6000	Ln Square Average GDP per capita 1960; 1970; 1980; 1990; 2000	95%
LN2GpcGDP_0060		95%

Gini_60	Gini 1960	96%
Gini_00	Gini 2000	90%
trade_60	Trade (%GDP) 1960	85%
trade_70	Trade (%GDP) 1970	91%
trade_80	Trade (%GDP) 1980	98%
trade_90	Trade (%GDP) 1990	100%
trade_00	Trade (%GDP) 2000	100%
avg_trade60_00	Average Trade (%GDP) 1960; 1970; 1980; 1990; 2000	51%
Agr_GDP60	Agriculture, value added (% of GDP) 1960	80%
Agr_GDP70	Agriculture, value added (% of GDP) 1970	83%
Agr_GDP80	Agriculture, value added (% of GDP) 1980	97%
Agr_GDP90	Agriculture, value added (% of GDP) 1990	98%
Agr_GDP00	Agriculture, value added (% of GDP) 2000	98%
avgAgr_GDP60_00	Average Agriculture (%GDP) 1960; 1970; 1980; 1990; 2000	51%
Ind_GDP60	Industry, value added (% of GDP) 1960	80%
Ind_GDP70	Industry, value added (% of GDP) 1970	83%
Ind_GDP80	Industry, value added (% of GDP) 1980	96%
Ind_GDP90	Industry, value added (% of GDP) 1990	98%
Ind_GDP00	Industry, value added (% of GDP) 2000	98%
avgInd_GDP6000	Average Industry (%GDP) 1960; 1970; 1980; 1990; 2000	37%
un_r70	Total Unemployment - Rates 1970	57%
un_r80	Total Unemployment - Rates 1980	71%
un_r90	Total Unemployment - Rates 1990	96%
un_r00	Total Unemployment - Rates 2000	98%
Infor_GDP	Informal Economy) GDP average 99-07	93%
LN_RMP60	Ln (Real Market Potential Redding and Venables Method 1960)	99%
LN_RMP00	Ln (Real Market Potential Redding and Venables Method 2000)	93%
RMP_60	Real Market Potential Redding and Venables Method 1960	95%
RMP_70	Real Market Potential Redding and Venables Method 1970	95%
RMP_80	Real Market Potential Redding and Venables Method 1980	99%
RMP_90	Real Market Potential Redding and Venables Method 1990	99%
RMP_00	Real Market Potential Redding and Venables Method 2000	93%
LN_FMP_60	Ln Foreign Market Potential (not include own country demand) 1960	99%
LN_FMP_00	Ln Foreign Market Potential (not include own country demand) 2000	93%
G(LnFMP00_LnFMP60)	Rate of Growth Foreign Market Potential (Ln FMP 2000 - Ln FMP 1960)	93%
FMP_60	Foreign Market Potential (not include own country demand) 1960	95%
FMP_70	Foreign Market Potential (not include own country demand) 1970	95%

FMP_80	Foreign Market Potential (not include own country demand) 1980	99%
FMP_90	Foreign Market Potential (not include own country demand) 1990	99%
FMP_00	Foreign Market Potential (not include own country demand) 2000	99%
LNavgFMP_6000	Ln Average Foreign Market Potential 1960; 1970; 1980; 1990; 2000	100%
LN_land area sqkm	Ln Land area	100%
Land area sqkm	Land area (sq. km)	100%
LN_Agroland60	Ln Agro land (sq. km) 1960	100%
LN_Agroland00	Ln Agro land (sq. km) 2000	100%
Tertile_Land	Tertiles Lans area (sq.km) (1 largest and 3 smaller)	100%
Large_land	Dummy large areas	100%
Middle_land	Dummy middle area	100%
Small_land	Dummy small area	100%
Agrland_60	Agricultural land (sq. km) 1960	90%
Agrland_70	Agricultural land (sq. km) 1970	100%
Agrland_80	Agricultural land (sq. km) 1980	90%
Agrland_90	Agricultural land (sq. km) 1990	100%
Agrland_00	Agricultural land (sq. km) 2000	90%
shAgrland_60	Agricultural land (% of land area) 1960	91%
shAgrland_70	Agricultural land (% of land area) 1970	90%
shAgrland_80	Agricultural land (% of land area) 1980	90%
shAgrland_90	Agricultural land (% of land area) 1990	100%
shAgrland_00	Agricultural land (% of land area) 2000	100%
avgshAgrland_6000	Average Agricultural land (% of land area) 1960; 1970; 1980; 1990; 2000	100%
Desert	% Desert	100%
Tropic	% Tropical climate	100%
Rugged	Ruggedness Index	99%
Landlock	Dummy Country Landlock	100%
Distcoast	Distance to nearest ice-free coast (1000 km) (Distant coast)	100%
Nearcoast	% Within 100 km of ice-free coast (Near Cost)	99%
INT_dist	Internal Distance of country (dist int) (km)	99%
LN_INT_dist	Ln Internal Distance of country (dist int) (km)	99%
GEOdist	Average Geodesic distance between capitals	99%
LN_GEOdist	Ln average Geodesic distance between capitals	57%
Dens_road60	Density Paved Road (Km P.Road/land area) 1960	70%
Dens_road70	Density Paved Road (Km P.Road/land area) 1970	72%
Dens_road80	Density Paved Road (Km P.Road/land area)1980	95%
Dens_road90	Density Paved Road (Km P.Road/land area)1990	43%

Dens_road00	Density Paved Road (Km P.Road/land area)2000	99%
avgDens_road6000	Average Density Paved Roads 1960; 1970; 1980; 1990; 2000	77%
Dens_rail60	Density Rail Line (Km Rail/land area) 1960	77%
Dens_rail70	Density Rail Line (Km Rail/land area) 1970	81%
Dens_rail80	Density Rail Line (Km Rail/land area) 1980	83%
Dens_rail90	Density Rail Line (Km Rail/land area) 1990	78%
Dens_rail00	Density Rail Line (Km Rail/land area) 2000	83%
avgDens_rail6000	Average Density Rail Lines 1960; 1970; 1980; 1990; 2000	100%
LAC	Dummy Latin America and Caribbean	100%
AFR	Dummy Africa	100%
ASI&ME	Dummy Western Europe	100%
EEU	Dummy Eastern Europe	100%
WEU	Dummy Offshoots	100%
OFF	Dummy Asia & Middle East	100%
WEU&OFF	Dummy Western Europe and Offshoots	100%
Common	Legal origin indicator: Common law	100%
Civil	Legal origin indicator: French civil law	100%
Socialist	Legal origin indicator: Socialist law.	100%
German	Legal origin indicator: German civil law.	100%
Scand	Legal origin indicator: Scandinavian law.	100%
Colon_SP	Colonial origin indicator: Spanish.	100%
Colon_GB	Colonial origin indicator: British.	100%
Colon_FR	Colonial origin indicator: French.	100%
Colon_PR	Colonial origin indicator: Portuguese.	100%
Colon_Oth	Colonial origin indicator: Other European	85%
Demo_60	Democracy indicator 1960	87%
Demo_70	Democracy indicator 1970	89%
Demo_80	Democracy indicator 1980	91%
Demo_90	Democracy indicator 1990	100%
Demo_00	Democracy indicator 2000	84%
Auto_60	Autocracy indicator 1960	87%
Auto_70	Autocracy indicator 1970	88%
Auto_80	Autocracy indicator 1980	91%
Auto_90	Autocracy indicator 1990	99%
Auto_00	Autocracy indicator 2000	83%
Polity_60	Composity political regime (polity 2) 1960	84%
Polity_70	Composity political regime (polity 2) 1970	87%
Polity_80	Composity political regime (polity 2) 1980	85%
Polity_90	Composity political regime (polity 2) 1990	99%
Polity_00	Composity political regime (polity 2) 2000	99%
avgPolity_6000	Average Composity political regime (polity 2) 1960; 1970; 1980; 1990; 2000	85%
Exec_60	Executive recruitment 1960	87%
Exec_70	Executive recruitment 1970	88%
Exec_80	Executive recruitment 1980	91%
Exec_90	Executive recruitment 1990	99%
Exec_00	Executive recruitment 2000	100%
avgExec_6000	Average Executive recruitmen 1960; 1970; 1980; 1990; 2000	100%

Appendix 1.2

Group SAMEk: Cities that in 1960 and 2000 remained in the same k^th^ category

Category Mega (SAME)	City Size 1960	City Size 2000
Tokyo	1	1
New York	1	1

Category Big (SAME)	City Size 1960	City Size 2000
Paris	2	2
Essen	2	2
Moscow	2	2
London-UK	2	2
Chicago	2	2

Category Midsize (SAME)	City Size 1960	City Size 2000
Melbourne-Aust	3	3
Sydney	3	3
Wien	3	3
Montréal	3	3
Toronto	3	3
Guangzhou	3	3
Harbin	3	3
Shenyang	3	3
Al-Iskandariyah [A	3	3
Berlin	3	3
Düsseldorf	3	3
Frankfurt (am Ma	3	3
Hamburg	3	3
Köln	3	3
Athínai [Athen]	3	3
Budapest	3	3
Milano	3	3
Napoli	3	3
Rome	3	3
Nagoya	3	3
Kattowitz	3	3
Singapore	3	3
Barcelona-Sp	3	3
Madrid	3	3
Birmingham-UK	3	3
Manchester	3	3
Boston	3	3
Cleveland	3	3
Detroit	3	3
Newark	3	3
Philadelphia	3	3
Pittsburgh	3	3
San Francisco-US	3	3
St. Louis	3	3
Washington	3	3

Legend
1=Mega
2=Big
3=Midsize

Group *IN*k: Cities that entered in the k^{th} category in 2000

Category Mega (IN)	City Size 1960	City Size 2000
Buenos Aires	2	1
Beijing	2	1
Shanghai	2	1
Kolkata (Calcutta)	2	1
Osaka	2	1
Ciudad de Mexico	2	1
Los Angeles	2	1
Rio de Janeiro	3	1
São Paulo	3	1
Al-Qahirah [Cairo, Kairo]	3	1
Delhi	3	1
Mumbai (Bombay)	3	1
Jakarta	3	1
Karachi	3	1
Manila	3	1
Dhaka	4	1
Lagos*	4	1

Category Big (IN)	City Size 1960	City Size 2000
Santiago-Chi	3	2
Chongqing	3	2
Tianjin	3	2
Wuhan	3	2
Victoria (Xianggang)	3	2
Chennai (Madras)	3	2
Tehran [Teheran]	3	2
Lima	3	2
Leningrad	3	2
Seoul	3	2
?im?	3	2
Krung Thep [Bangkok]	3	2
Istanbul	3	2
Bogotá (Santa Fe de)	4	2
Bangalore	4	2
Hyder?b?d	4	2
Lahore	4	2
Kinshasa	5	2

Legend

1=Mega

2=Big

3=Midsize

4= Small

5=Town

See below Category Midsize (IN)

Category Midsize (IN)	City Size 1960	City Size 2000
Brisbane	4	3
Baki (Baku)	4	3
Minsk	4	3
Belo Horizonte	4	3
Fortaleza	4	3
Porto Alegre	4	3
Recife	4	3
Salvador	4	3
Vancouver	4	3
Changchun	4	3
Changsha	4	3
Chengdu	4	3
Dalian	4	3
Guiyang	4	3
Hangzhou	4	3
Heze	4	3
Jinan	4	3
Kunming	4	3
Lanzhou	4	3
Linyi	4	3
Liupanshui	4	3
Nanchang	4	3
Nanjing	4	3
Pingxiang	4	3
Qingdao	4	3
Shijiazhuang	4	3
Taian	4	3
Taiyuan	4	3
Tangshan	4	3
Tianmen	4	3
Wanxian	4	3
Xian	4	3
Xiantao	4	3
Yancheng	4	3
Yulin	4	3
Zhengzhou	4	3
Medellín	4	3
La Habana	4	3
Adis Abeba	4	3
Mannheim	4	3
Ciudad de Guate	4	3
Ahmedabad	4	3
K?npur	4	3
Lucknow	4	3
N?gpur	4	3
Pune (Poona)	4	3
Bandung	4	3
Surabaya	4	3
Bagdad	4	3
Tel Aviv-Yafo [Te	4	3

Category Midsize (IN)	City Size 1960	City Size 2000
Kitakyoshu	4	3
Kyoto	4	3
Beirut	4	3
Guadalajara	4	3
Monterrey	4	3
Casablanca	4	3
Yangon	4	3
Ibadan	4	3
Warszawa	4	3
Lisboa	4	3
Buceresti	4	3
Cape Town	4	3
Johannesburg	4	3
Pusan	4	3
Taegu	4	3
Stockholm	4	3
Dimashq	4	3
T*nis	4	3
Ankara	4	3
Izmir	4	3
Kharkiv [Kharkov	4	3
Kyyiv [Kiev, Kiew	4	3
Anaheim (Orang	4	3
Atlanta	4	3
Baltimore	4	3
Dallas	4	3
Denver	4	3
Houston	4	3
Miami	4	3
Minneapolis	4	3
Norfolk	4	3
Phoenix	4	3
San Diego	4	3
San Jose-US	4	3
Seattle	4	3
Tampa	4	3
Toshkent (Tašker	4	3
Caracas	4	3
Ha Noi	4	3
Thanh Pho Ho Ch	4	3
Kabul	5	3
Chittagong	5	3
Belem	5	3
Brasilia	5	3
Campinas	5	3
Curitiba	5	3
Douala	5	3
Handan	5	3
Jinxi	5	3
Wenzhou	5	3

Category Midsize (IN)	City Size 1960	City Size 2000
Xuzhou	5	3
Yantai	5	3
Zaozhuang	5	3
Barranquilla	5	3
Cali	5	3
Abidjan	5	3
Santiago (Santiag	5	3
Santo Domingo	5	3
Guayaquil	5	3
Quito	5	3
Accra	5	3
Conakry	5	3
Bhop?l	5	3
Jaipur	5	3
Kochi (Cochin)	5	3
Ludhi?na	5	3
Surat	5	3
Vadodara (Baroc	5	3
Visakhpatnam	5	3
Medan	5	3
Esfahan [Isfahan]	5	3
Mashhad [Mesch	5	3
Tabriz [Täbris]	5	3
Sapporo	5	3
Nairobi	5	3
Antananarivo (Ta	5	3
Puebla	5	3
Maputo	5	3
Faisalabad	5	3
Gujranwala	5	3
Multan	5	3
Peshawar	5	3
Rawalpindi	5	3
Quezon City	5	3
Porto	5	3
Dschidda (Jedda)	5	3
Er-Riyadh	5	3
Dakar	5	3
Pretoria*	5	3
Incheon	5	3
Taejon	5	3
al-Harum	5	3
Umm Durm*n	5	3
?alab	5	3
Dar es Salaam*	5	3
Tabora	5	3
Riverside	5	3
Maracaibo	5	3
Valencia	5	3
Hai Phong	5	3
Sana	5	3
Lusaka	5	3
Harare	5	3

2. Why Cities Exist, Raise and Decline? A Theoretical Review of Urban Dynamics

2.1. Introduction

After observing the striking urbanization trends of the last decades, this chapter analyzes the main economic theories that have explained the phenomenon of cities growth, their decline and the links between the urban structure and economic development.

Firstly, we will analyze the reasons of cities' existence, their nature and dynamics. For this aim, different disciplinary and theoretical points of views will be considered: historical studies, philosophy and economics to understand one of the most complex human inventions.

Secondly, urban dynamics will be analyzed using the theoretical framework of urban economics, which contributions want to answer two main questions: (1) when the spatial concentration of economic activity becomes sustainable? and (2) when a symmetric equilibrium, without spatial concentration, is unstable? (Fujita *et.al.*, 1999).

Therefore, two different perspectives are taken into account in the analysis of urban dynamics. One focused on the observation of *intra-cities dynamics* characterized by the interaction between agglomeration and dispersion forces and the other focused on *inter-cities dynamics*, characterized by a particular setting of interacting cities.

The chapter is divided in five parts. The first part examines the existence of cities considering authors such as Aristotle, Bairoch and Smith; additionally we assess the concepts of pecuniary and technological externalities. The second part considers the spatial economic perspective, where the main economic factors that shape the urban landscape are considered. We review the contributions of Von Thünen (1826) and Christaller (1933). Then we deepen the spatial economic theory considering the interactions between agglomeration and dispersion forces, where the contributions of Krugman (1991) and Helpman (1995) are assessed, as well as the process that leads to the birth of megalopolis according Mori (1997). The thrid part analyses the links between economic development and agglomeration patterns, where key contributions given by Wheaton and Shishido (1981) are considered. The fourth part considers the role of politics and policies in shaping agglomerations. We review the contributions of Krugman and Livas (1992) about the links between large third world metropolis and openness. Then we analyze the empirical contribution of Ades and Glaeser (1995) which is considered a milestone in the study of agglomerations and the work of Davis and Henderson (2003) due to their study on non linear links between primacy and economic and demographic variables. Finally, the fifth part analyzes the possible links between the "deep determinants" of economic growth and urban structure.

The theoretical and empirical literature presented does not offer a complete review; it is simply an analysis of some basic approaches and findings that provide a remarkable understanding of the city as a complex phenomenon, where the institutional, economic, and geographical settings exert different effects on rise and decline processes. The theories are presented according a chronological criterion; however, some exceptions have been made in order to present a coherent theoretical structure.

2.2 Why Cities Exist?

This simple but complex question has been a common-place in several disciplines, which have contributed to elucidate the different underlying factors in the formation of cities. Below it is presented a short review of the contributions done by historians, philosophers and economists, in their aim to understand this phenomenon, which represents one of the most prominent signs of civilization, and of the achieved level of development.

2.2.1. The Historical Perspective

The contribution of history is certainly fundamental to understand the main drivers behind the raising of the city. Historians, to study the invention of the city, required a clear definition about this phenomena to differentiate a city from others human settlements, such as villages or pre-urban cities.

Bairoch (1988) suggested five conditions that a settlement should fulfill to be considered as city:

1. The existence of full-time craftsmen, as evidence of division of labor.
2. The existence of fortifications or walled enclosures.
3. A population of sufficient size and density.
4. Houses built with durable materials and an organized urban space (i.e. streets).
5. The presence of permanent settlers.

A consensus among historians and archeologist is that cities appear in the Neolithic, about 9500 B.C. (which coincides with the appearance of the agriculture), as result of demographic pressures (Boserup, 1965). This is called the Neolithic revolution, where men passed from a nomad to a sedentary stadium. These considerations opened a large debate about what induced the development of agriculture: was the population pressure to force the beginning of agriculture or the discovery of agriculture which impelled population?

Both historians and archeologists agree that it was the discovery of agriculture which induced men to change their nomad life; hence with the creation of permanent settlements some of then became cities. This fact explained the location pattern of ancient cities, usually located in areas suitable to agricultural activities; hence with access to water, good quality of land and a proper climate.

Thanks to agriculture, it was possible to observe, periodically, food surpluses. This revolutionary fact changed the habits for feeding and shelter and modified the way of living.

Bairoch (1988), using several analyses of ancient transport systems, demonstrated that it was agriculture which allowed overcoming the *tyranny of distances*. Without agriculture the distance that nomads would require to cover for feeding a small town would be unmanageable.

> "The constraints of transportation costs, in conjunction with the very thin population density in pre-Neolithic societies, explain the impossibility of the emergence of true cities […] Given the limited possibilities of transportation available at the time, the task of organizing the flow of trade required to maintain a simple city of 1,000 inhabitants […] was clearly impossible, For this reason it is not until the Neolithic and the invention of agriculture that the first signs of true urbanization appear." (Bairoch, 1988, 13).

Food surpluses played a fundamental role in the formation of cities because: (1) reduced the problem of feeding, contributing to the growth of population; (2) allowed the existence of permanent settlements, precondition for the establishment of a city; (3) gave the possibility to exchange food surpluses with other scarce supplies, enhancing the development of the market within and between settlements.
These elements progressively required a higher *institutional* and *spatial* organization to allow a more efficient, safe and enjoyable "civil" life.

2.2.2. The Philosophical Perspective

One of the first explanations of how and why cities exist is given by Aristotle, who describes its origins passing from families in rural areas to small villages and finally to the formation of a city, as a self-contained unity which possess social, economical and political elements that permit an improvement in the quality of life (material and relational):

> "the society of many families, which was first instituted for their lasting, mutual advantage, is called a village, [...] and when many villages so entirely join themselves together as in every respect to form but one society, that society is a city, and contains in itself, if I may so speak, the end and perfection of government: first founded that we *might live*, but continued that we

> may *live happily*. For which reason every city must be allowed to be the work of nature, if we admit that the original society between male and female is; for to this as their end all subordinate societies tend, and the end of everything is the nature of it..."[1] (Aristotle, Politics, Book I, Chapter II, 1252b).

For the great philosopher, man (*zoon politikon*) cannot be understood without its relational capacity, which creates families and continues a process of building mutual advantages until the achievement of the city, considered as an institution which facilitates the supply of goods and foster happiness through a life in community.

This human dynamic impelled the formation of villages, which started to expand their size. This fact increases the complexities of the common life, demanding higher organizational and institutional arrangements, process that led to the formation of the city, considered as the great invention of civilization.

For Aristotle, the *polis* (πόλις) translated as city-state or city, is defined as a political partnership.

> "It is clear that all partnerships aim at some good, and that the partnership that is most authoritative of all and embraces all the others does so particularly, and aims at the most authoritative good of all. This is what is called the city or the political partnership" (Aristotle, Politics, Book I, Chapter II, 1252a).

The city is conceived as a complex institutional arrangement which configures a particular political partnership of the community. This different arrangements and partnerships cannot be efficiently pursued without a certain spatial configuration of the city. Greek cities rotated around the *Àgora,* an open and accessible place to all citizens in which they could interact in political, economical and cultural matters, creating an immanent common area or *locus*.

These three spheres –culture, politics, economics having all different weights- represent the key elements on which the city rotates, which require mutual support for their stability and development. Markets require the support of political or legal institutions; policies require the support of culture, ideas and education*.* Therefore, it was rational to locate them in the same spatial area, "square" *or Àgora,* at the center or the city*,* working as axis on which the civilization rotates*.*

In fact, ancient, medieval and several modern cities are characterized by the presence of a *locus,* where civil, religious authorities, as well as areas for the exchange of goods and ideas are located. In other words, the center of the city, as relational city summit, was

[1] Own italics.

characterized by the presence of the institutions that gave support to the functioning of the *polis*.

The stability of the *polis* required cohesive institutional arrangements, which only could be guaranteed by an active social engagement of the citizens. This cohesion was understood to be a unity among diversities (Aristotle, Politics Book II, Chapter II), which was considered a complex matter to achieve.

In this sense, Greeks were extremely concerned about the problem of cities size. For Aristotle the greatness of a state was not related to their population size; he considered almost impossible for a state with large population to pursue a legal government. On the other hand, Plato's concerns on city size were about the feasibility of hosting all the heads of families in a public meeting (Plato, Laws v. 74) in order to guarantee the engagement of citizen in public matters.

The concern on cities sizes correspond to the idea that largest cities were not able to engage in a proper way the citizens of the *polis*, essential characteristic for the establishment of a democratic government. Indeed, Greek's city-states where characterized by being small towns (in our current parameters), conformed by a population of about 30,000 inhabitants.

Plato's ideal city size was about 20,000 inhabitants or 5,040 head of family. This optimal city size should not only contribute to the political engagement already mentioned, but should provide an equal and organized distribution of land and housing to guarantee the stability of the city-state.

> "5040-this will be a convenient number; and these shall be owners of the land and protectors of the allotment. The houses and the land will be divided in the same way, so that every man may correspond to a lot. Let the whole number be first divided into two parts, and then into three; and the number is further capable of being divided into four or five parts, or any number of parts up to ten. […] that number which contains the greatest and most regular and unbroken series of divisions. The whole of number has every possible division, and the number 5040 can be divided by exactly fifty-nine divisors, and ten of these proceed without interval from one to ten: this will furnish numbers for war and peace, and for all contracts and dealings, including taxes and divisions of the land." (Plato, Laws V)

Summarizing, it can be stated that for Greek philosophers, the invention of cities is the result of the human need to resolve, in an efficient way, the problem of scarcity (economical aim) and provide an adequate environment where people can deploy their relational capacities to construct a transcendental institutional setting to pursue happiness (political aim), as Aristotle remarked.

2.2.3. The Economic Perspective

The economic science has contributed in a relevant way to understand the existence of cities, due to the specific weight that the economic activity has in shaping agglomerations.

> "…I shall chiefly focus here on the relations between urbanization and the economy, relations that determined the rise as well as the development of urbanism at as still more fundamental level. If, as will be seen, attention is turned not to particular cases but to the the emergence of urban civilization in general, the economic variable will be found to be preponderant" (Bairoch, 1988:93).

Main contributions were done by Smith (1776), when he analyzed the human propensity to exchange and the importance of the division of labor to increase the economic efficiency of businesses and markets.

This remarks the existence of a natural tendency of men to enter into relation with others. This human action and inter-action is expressed in the economic dimension, through the activity to exchange:

> "[there is] a certain propensity in human nature (…) to truck, barter, and exchange one thing for another." Smith (1776: Book I, II).

This innate relational propensity and the need of sheltering and feeding families in an efficient way, led to the creation of cities, where the market had a predominant role. Nevertheless, the advantages to exchange or trade cannot efficiently achieve without the specialization of activities allowed by the division of labor.

Smith (1776) pointed out that the extraordinary economic benefits that division of labor brought cannot be reinforced without the city.

> "As it is the power of exchanging that gives occasion to the division of labor, so the extent of this division must always be limited by the extent of that power, or, in other words, by the extent of the market. When the market is very small, no person can have any encouragement to dedicate himself entirely to one employment (…). There are some sorts of industry, even of the lowest kind, which can be carried on nowhere but in a great town. A porter, for example, can find employment and subsistence in no other place. A village is by much too narrow a sphere for him; even an ordinary market-town is scarce large enough to afford him constant occupation.."(Smith, 1776:Book I, III)

For Smith, the city and its size plays a critical role to increase the efficiency of the market. In villages, for survival people are forced to do different activities such as growing crops, building shelters, provide education and health. Perhaps, in some activities an individual has the appropriate knowledge inherited by the family or has the will to do a particular work that matches with his abilities. Or, perhaps, for other activities he does not have proper skills, producing goods and services not efficiently. However in presence of a larger community, the individual can be specialized in a certain activity where combining his knowledge and abilities he could supply more efficiently the community. In this context, people will tend to be specialized, fact that is beneficial for the individual and for the whole community; because collaboration and specialization walk together. This implies that the village will tend to increase its population until it achieves an efficient size or when division of labor can express its potentialities. However, does this implies that all villages will become cities?

Not necessarily, because not all the villages have the organizational capacity to engage in an efficient way new population and/or have an attractive territorial environment which facilitates life, such as rivers, arable land or mountains that provided a natural defense towards enemies.

Another key economic element that had a significant contribution in the raise of cities are transport costs. When people are clustered, trade and services can be exchanged at lower costs, which increase the efficiency of the economy. This fact also incentives people and economic activities to be one next to the other.

Market size, division of labor and transport costs become “classic” economic factors that are improved by the presence of the city. However, the fact of agglomerations and their size, creates other dynamics that can affect positively or negatively their efficiency. These are known as spatial externalities which present different forms.

2.2.4. Spatial Externalities

When spatial externalities are considered, generally two main ideas emerge: (1) That Marshall (1890) was the first to assess the phenomenon of industrial clustering and (2) that technological externalities is the factor which explains forces that generate agglomeration. However both ideas are not precise, because Marshall was not the first in analyzing such phenomenon, and for him, technological spillovers were not the only type of externalities that explained the industrial agglomeration.

In a posthumous paper - written between 1826 and 1842 - Von Thünen wrote:

> “(1) Only in large-scale industrial plants is it profitable to install labour-saving machinery and equipment, which economies on manual labour and make for cheaper and more efficient production. (2) The scale of an industrial plant depends on the demand for its products . . . (4) For all these reasons, large scale plants are viable only in the capital in many branches of industry. But the division of labour (and Adam Smith has shown the immense influence this has on the size of the labour product and on economies of production) is closely connected with the scale of an industrial plant. This explains why, quite regardless of economics of machine-production, the labour product per head is far higher in large than in small factories . . . (7) Since it takes machines to produce machines, and these are themselves the product of many different factories and

> workshops, machinery is produced efficiently only in a place where factories and workshops are close enough together to help each other work in unison, i.e. in large towns. Economic theory has failed to adequately appreciate this factor. Yet it is this which explains why factories are generally found communally, why, even when in all other respects conditions appear suitable, those set up by themselves, in isolated places, so often come to grief. Technical innovations are continually increasing the complexity of machinery; and the more complicated the machines, the more the factor of association will enter into operation. (Von Thünen, 1826/1966, pp. 287–90)"[2]

According to Von Thünen, the agglomeration process towards the main city is explained by the necessities of large industries; requiring higher demand to exert the benefits of the economies of scale, these industries decide to locate at the main city, where other complementary industries will also move to achieve higher efficiency and more product diversification. Finally, he considers the role of technical innovation as another agglomeration force, because increasing complexity of machinery demands more collaboration. As we can see, Von Thünen identified different types of externalities that affect agglomeration; in the following years, this externalities will be known as pecuniary and technological.

In his model of Von Thünen explains how, in a perfect equilibrium, activities are agglomerated in concentric rings where the location pattern is driven by market interactions.

Deepening Von Thünen's analysis, Fujita remarks that in a perfect competition scenario -as the Isolated States represent- pecuniary externalities explain better than technological externalities the location decision of firms:

> "After all, determining which crops to grow where is not that easy. By allocating an acre of land near the Town to some crop, you indirectly affect the costs of delivering all other crops, because you force them to be grown further away. Furthermore, in Thünen's original model in The Isolated State, the wage of farmers at each distance from the Town is to be endogenously determined such that the utility of farmers, who consume crops grown in the field as well as goods manufactured at the Town, is the same everywhere" (Fujita, 2010:6).

But besides the great contribution of Von Thünen, only with Marshall (1890) the concept of spatial externalities has been fully introduced in the economic literature. Spatial externalities capture the idea that agglomeration is the outcome of a "snowball effect" in which a growing number of agents want to take advantage of a larger dimension of activities and a higher specialization. (Fujita, 2002:8).

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[2] From Fujita 2010, who is quoting Section 2.6 in Part II of Thünen's posthumous papers written between 1826 and 1842 and edited by Hermann Schumacher in 1863.

The analysis of Marshall opened a large debate about the role of industrial specialization (usually know as Marshallian externalities) or diversification (Jacobian externalities[3]). This debate is still open (Panne and Beers, 2006).

It is interesting that Marshall's analysis was not only focused on the technological aspects of externalities but also on pecuniary. According Breschi and Lissoni (2001) Marshall identified three types of location economies:

(1) *Economies of Specialization*, where localized industries supported specialization of local suppliers producing a variety of goods at lower cost.

(2) *Labor Market Economies*, where localized industries created pools of similar skilled labor;

(3) *Knowledge spillovers*, where face to face interaction contributes to the flow of novelties, impelling innovation.

Type 1 and 2 are supposed to be pecuniary or rent externalities, whereas type 3 technological. The first two are pecuniary because

> "allow co-localized firms to access traded inputs and labour at a lower prices that rivals locates elsewhere; as such, they occur through market interactions" (Breschi and Lissoni, 2001:979)

For Marshall firms' location depend on several factors; the first one refers to the availability of natural resources, which attract people to exploit them and generate a particular economic setting. The second factor regards the presence and the management of courts, which to increase their production and wealth, attracted skilled labor to create the appropriate knowledge endowment for a particular type of economic activities. Finally, a set of new attracting factors appear with the presence of the agglomeration of specialized industries (industrial district), which concentrate skilled labor, demand new technological solutions, better supplies and infrastructures. These elements impel innovations and provide an attractive business environment, where new ideas spill over the spatial area creating superior economies of scale for firms:

> "Many various causes have led to the localization of industries; but the chief causes have been *physical conditions*; such as the character of the climate and the soil, the existence of mines and quarries in the neighborhood, or within easy access by land or water (...)

[3] According to Jacobs (1969), the emergence of knowledge externalities depends of the economic environment characterized by diversified and complementary industries, rather than specialized industrial settings. It means that cross-fertilization of knowledge is produced by the presence of different industrial settings, being this the natural environment to enhance innovation capabilities and growth. For Jacobs, diversity is greater in cities; she called theses agglomerations forces urbanization (diversification) economies.

> Another chief cause has been the *patronage of a court*. The rich fold there assembled make a demand for goods of specially high quality, and this attracts skilled workmen from a distance, and educates those on the spot. When an Eastern potentate changed his residence—and, partly for sanitary reasons, this was constantly done—the deserted town was apt to take refuge in the development of a specialized industry, which had owed its origin to the presence of the court. (...) When an industry has thus chosen a locality for itself, it is likely to stay there long: *so great are the* advantages which *people following the same skilled trade* get from near neighborhood to one another. The mysteries of the trade become no mysteries; but are as it were in the air, and children learn many of them unconsciously. Good work is rightly appreciated, inventions and improvements in machinery, in processes and the general organization of the business have their merits promptly discussed: if one man starts a new idea, it is taken up by others and combined with suggestions of their own; and thus it becomes the source of further new ideas. And presently subsidiary trades grow up in the neighborhood, supplying it with implements and materials, organizing its traffic, and in many ways conducing to the economy of its material" (Marshall, 1890 Book IV, 10. Own italics).

It was with Scitovsky (1954) that the concept of spatial externalities became more organized. He considered two types of spatial externalities: technological and pecuniary. *Technological externalities* are also called spillovers or "pure *Marshallian" externalities* (Fafchamp, 1997); these capture *non-market interaction* between firms and have a direct effect on production through physical proximity. On the other hand, *pecuniary externalities* are characterized by *market interaction* where firms are indirectly affected by price mechanisms*.*

With Krugman (1991), pecuniary externalities began to be considered the predominant type of externalities that affect urban agglomerations. For Krugman, firms' location decisions are particularly influenced by the decision to increase access to large markets and to reduce transport costs. A closer location to larger markets enhances firms' increasing returns to scales and facilitates the attendance of periphery markets. Pecuniary externalities are explained by Krugman (1991) as follows:

> "imagine a country in which there are two kinds of production, agriculture and manufacturing. Agricultural production is characterized both by constant returns to scale and by intensive use of immobile land. The geographical distribution of this production will therefore be determined largely by the exogenous distribution of suitable land. Manufactures, on the other hand, we may suppose to be characterized by increasing returns to scale and modest use of land. Where will manufactures production take place? Because of economies of scale, production of each manufactured good will take place at only a limited number of sites. Other things equal, the preferred sites will be those with relatively large nearby demand, since producing near one's main market minimizes transportation costs. Other locations will then be served from these centrally located sites." (Krugman, 1991:485)

According to Krugman, pecuniary externalities are crucial to understand the process of agglomeration. In fact, imperfect competition (product differentiation), economies of scale and "love for variety" in consumer's preferences, are the main forces that drives industrial location and make markets extremely important. Firms and workers look for product variety which allows them to have better supplies and more goods available in the same place, implying savings in transport costs for both economic agents.

> "In competitive general equilibrium, of course, pecuniary externalities have no welfare significance and could not lead to the kind of interesting dynamics we shall derive later. Over the past decade, however, it has become a familiar point that in the presence of imperfect competition and increasing returns, pecuniary externalities matter; for example, if one firm's actions affect the demand for the product of another firm whose price exceeds marginal cost, this is as much a "real" externality as if one firm's research and development spills over into the general knowledge pool. At the same time, by focusing on pecuniary externalities, we are able to make the analysis much more concrete than if we allowed external economies to arise in some invisible form. (This is particularly true when location is at issue: how far does a technological spillover spill?" (Krugman, 1991:485)

The arguments about the prevalence of pecuniary on technological externalities in agglomeration patterns can be puzzling. Nonetheless, it should be remarked that the New Economic Geography (NEG) does not deny the role of Marshall's observations. What NEG states is that pecuniary externalities exert a stronger effect on location decision; suggestion that seems to be closer to Von Thünen's ideas.

In a subsequent analysis, Ottaviano and Thisse (2001) argue that technological spillovers tend to be stronger among limited spatial dimensions; whereas pecuniary externalities provide a more convincing explanation at larger scales. This is connected with a long lasting literature (see Henderson, 1974) for which location economies tend to be industry-specific, while diseconomies of agglomeration tends to depends on the overall size of the city.

This implies that the effects of technological externalities (resulting from non-market interaction) on agglomeration are stronger at smaller space scales such as industrial districts. The case would be different at larger agglomeration scales, such as large cities, where pecuniary externalities can explain in a better way the agglomeration patterns.

Furthermore, the intensification of the role of knowledge and technology in any kind of industry shows that non-market interactions are becoming much more formalized through market mechanism. Breschi and Lissoni (2001) considered that technological externalities are not necessarily at the side of market interactions; instead they observe an increasing market interaction of well regulated knowledge flows between firms which possess clear appropriation purposes and considered technological and pecuniary externalities as follows:

> "1. What might appear, at first, as 'pure' knowledge externalities are actually pecuniary externalities, which are mediated by economic (market and non-market mechanism) such as the labor market, the market for technologies and club or network agreements.
> 2. What might appear as involuntary knowledge spillovers are actually well-regulated knowledge flows between academic institutions (or individuals therein) and firms, or across firms, which are managed with deliberate appropriation purposes.
> 3. A large amount of the knowledge flowing in this way has much more to do with enhancing the innovation appropriation strategies of local companies (by speeding up the development phases of new products and processes) rather their innovation opportunities (by providing them new ideas)" (Breschi and Lissoni, 2001:1000).

As we have already reviewed, the existence of cities and their growth or decline, is shaped by complex economic and technological mechanisms, that we will analyze next.

2.3. Shaping Urban Spaces: Analyzing Agglomeration and Dispersion Forces

The forces that shape the urban landscape receive different names, such as agglomeration and dispersion forces; centripetal and centrifugal forces; location economies and diseconomies or congestion. All of them synthesize the main dynamics that affect cities sizes due to the presence of positive or negative pecuniary and technological externalities.

In studying economic development, the processes of urbanization and rural-urban migration have been broadly analyzed. Stands out the contribution of Lewis'(1954) with his dual economy model, where center-periphery patters and labor migration are considered. Todaro (1969) and Harris and Todaro (1970), make a step forward considering the expectation of real wages differentials between rural and urban spaces. However, more literature on urban dynamics comes from the urban or spatial economy strand.

Under a scenario of perfect competition and with the presence of a unique urban (market) center, agglomeration and dispersion forces generate a particular efficient urban landscape, as has been studied by Von Thünen (1826). Additionally, when economic efficiency - particularly transport cost and market sizes –is pursued, the Christaller's (1933) urban setting emerge; it is an organized and balanced hierarchically city system, where sizes interact dynamically and are not absorbed by a dominant city. However when we consider the interactions between economies of scale, product variety, factors' mobility and transport cost, the urban setting can become affected by strong centripetal and centrifugal forces which generate different possible equilibria, as has been deeply analyzed by Krugman (1991) and Fujita and Krugman (1995). Then, if we introduce housing and its cost as a centrifugal force even other equilibrium paths are also possible, dynamic that has been analyzed by Helpman (1995). Finally, if we consider a context with a dynamic manufacturing sector and declining transport costs, the urban congestion generates clustered new cities connected by industrial belts, which induce the emergence of megalopolis as Mori (1997) states. All these dynamics will be analyzed next.

2.3.1. The Emergence of a Spontaneous and Organized Urban Landscape

A milestone in the analysis of the underlying forces behind urban settings is Von Thünen's (1826) model. This may now seem simple and obvious, but it is actually an ingenious and deep analysis of how economic forces can generate unexpected insights (Fujita et. al. 1999).

Von Thünen introduced *The Isolated State* (1826) writing:

> "Imagine a very large town, at the centre of fertile plain which is crossed by no navigable river or canal. Throughout the plain the soil is capable of cultivation and of the same fertility. Far from the town, the plain turns into an uncultivated wilderness which cuts off all communication between this State and the outside world. There are no other towns on the plain. The central town must therefore supply the rural areas with all manufactured products, and in return it will obtain all its provisions from the surrounding countryside. The mines that provide the State with salt and metals are near the central town which, as it is the only one, we shall in future call simply "the Town.""

The model assumes a flat land in absence of any relevant roughness, where at the center is located the state (town or city). This state or city is isolated, cannot trade and exchange goods, services and labour with other cities. Manufactured goods are produced at the center and agriculture is located in the surrounding area. The decision of where should crops be located depends of the rents or profit achieved, which depends on the tradeoff between costs of land, transport cost to the market, quantity of crops that can be produced and market prices of the crops. In the model political elements are absents. As a consequence, Von Thünen's description perfectly corresponds to the *economic space* where three elements interact: land costs, transport costs and market prices.

The main concern of the model is to explain urban landscapes led by pure economic forces, based on the assumption that pursuing individual maximization of rent would create a spontaneous concentric production rings order. This pattern shows how economic rationality led to agglomerate similar types of economic activities within a distances range to the market (city center).

His analysis intuited the pillars of the spatial economics, where centripetal and centrifugal forces organize urban shapes. Introducing distances, transport costs, productivity of land (the "capital" factor in this model), prices of the various crops, production costs. Von Thünen ordered the different activities around the center according to the rent they can pay.

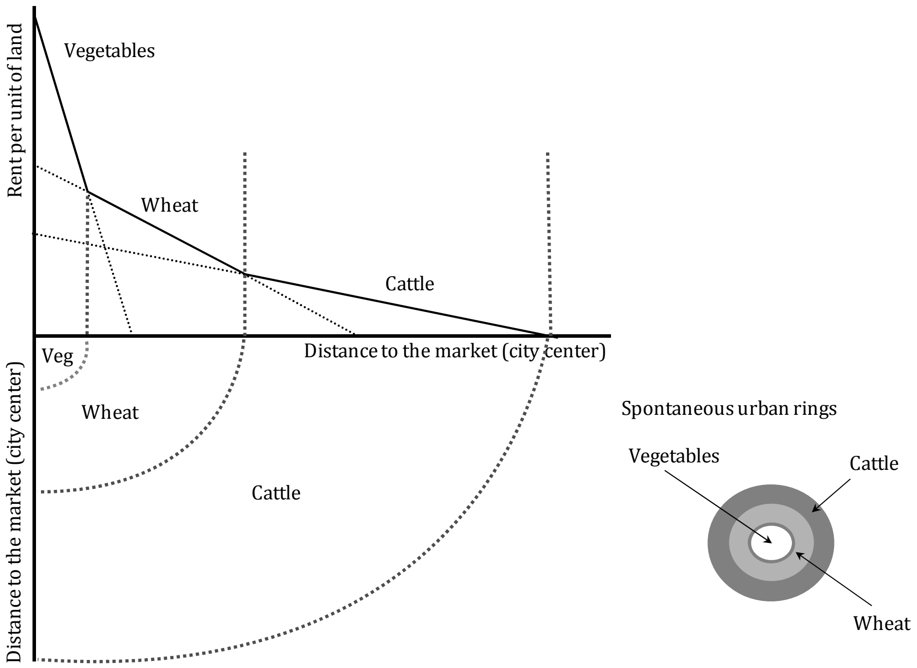
Let's assume:

R: rent per unit of land
Y: yield per unit of land
p: market price per unit of yield
c: cost per unit of yield
f: freight per unit of yield, and per unity of distance
m: geographical distance from market
then the rent per unit of land will be : **R=Y(p-c) – Yfm**

In his mono-centric spatial model, perfect competition is a key assumption. Bid rent curves of each economic activity (dotted straights lines) represent the rent that farmers are willing to pay at certain distance to the market. The heavy straight line (rent gradient) represents the market rent curve in equilibrium. It means that the location of each type of economic activity offers the highest possible bid rent. As consequence, concentric ring of cultivation around the city core arise.

The outcomes of the model are prominent. According to Samuelson (1983) Von Thünen elaborated one of the first models of general equilibrium using realistic economic parameters.[4]

Figure 2.1. Von Thünen spontaneous urban setting led by economic factors



Source: Fujita et. al. 1999, with few modifications.

[4] For more details on Samuelson assertions and the current relevance of Von Thünen model see Fujita (2010).

His model was re-discovered by Alonso (1964), when he used the same pillars of the model, changing the isolated state with a modern metropolis characterized by a Central Business District (CBD) and replacing farmers by city workers. According to his Bid Rent Model, in the y axis of Figure 2.1, instead of using rent per unity of land, like in Von Thünen, Alonso use rent per square meter of land in the city according to the distance from CBD. Therefore, the city will perform a spontaneous concentric order where at the center lay down retail and commercial buildings, in the second ring offices and finally residencies. Here emerges the role of distances, bid rents and market density in shaping urban patterns.

However, after Von Thünen, one of the most important contribution in the spatial economics comes from Christaller (1933), which using similar assumptions (i.e. isotropic land) but considering a net of interconnected cities, propose a particular urban setting.

2.3.2. Organized and Hierarchical Urban Structure: The Contribution of Christaller

The first hierarchical system was proposed by Christaller (1933) through his Central Place Theory, using an inductive method based on the observation of cities in southern Germany and assuming the presence of isotropic land, like an Euclidean plane, without roughness and weather changes, even distribution of population and resources in the area; similar purchasing power and proportional and similar transport cost according travel distances. He also considered that industries would be located in central places to grasp the benefits of scale economies, while consumers will commute to closer areas where it's possible to achieve more goods and services. He considered a central place city that will supply goods and services to their cities and to those that are located in the influence area of the city.

Christaller considered that cities are equally and hierarchically distributed in the space, on which each city has its own circular market area which is proportional to the level of goods and services that it supplies. These circular market areas, one attached to the other, would create a space with empty or not attended areas, being an inefficient city system.

He resolved the problem using a *beehive honeycomb* or hexagon urban grid, the construction of which requires three spheres of the same size[5], creating a perfect hexagonal tiling of market areas, which allow the most dense arrange of circles in an Euclidean plane (two dimensions)[6] without free spaces, giving a total coverage area by the central city and consumer can reach the closets central place. In this hexagonal city system are settled different areas of influence creating a hierarchal city system, where different city sizes supply different quantities and qualities of goods and services. The hexagon grid minimizes transport costs, facilitates the equal distribution of services (in terms of spatial

[5] See Euclid's Elements, Book IV, Proposition 15.

[6] This would explain –partly- why this geometrical form is found in different forms of nature and like in the graphite, providing also a particular strength.

distribution) and organizes market competition avoiding overlapping between market areas.

Under theses considerations, the Christallerian city system is characterized by:

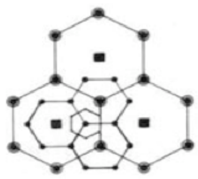
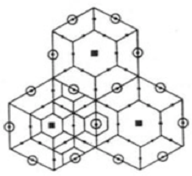
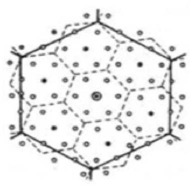
- Proportional relations between city sizes and distances to not overlap market areas. This means that the greater the urban centers, the greater the distance between them; the smaller the cities, therefore the smaller the distance.

- The higher the cities size, the fewer their number.

- The greater the size of the city, the greater the number of city functions; that is the greater the number of higher order services (higher specialization).

Theses characteristics are synthesized in the three main principles: the marketing principle, the transportation principle and the administrative principle (see Table 2.1)

Table 2.1. Christaller's spatial principles

	The ***marketing principle*** implies that market areas at a certain level are three times bigger than the next lower order. It means that if we have 2 cities (high level), we also have 6 towns (lower level), and 18 small towns or villages.
	The **transportation principle** means that cities in the central place serve an area 4 times the area that is served by cities of next lower order.
	The **administrative principle** a consider that an administrative center serves 6 more centers of the next lower level.

Source: Graphs comes from Christaller (1933)

The model has heavy limits that the literature has underlined (see for instance Fujita *et.al.*1999; and Capello 2004a for a review).

Firstly, the hypothesis of a homogeneous distribution of an immobile demand is totally unrealistic. The same existence of different urban centers (with the concentration of population) contradicts this assumption.

Secondly, the model does not consider interdependencies between productive activities and consequently does not consider the existence of both technological and pecuniary externalities, which in reality are very important in explaining the dimension and number of cities.

Nonetheless, Christaller's general equilibrium model is very important to explain, with very few basic assumptions, how an urban system is structured in an optimal way (that is with firms maximizing profits and individuals maximizing utility).

This is why we will refer to Christaller's model as an "ideal" reference of a well performed urban system.

2.3.3. Increasing Returns, Product Differentiation and Transport Costs: The Contribution of Krugman

The "New Economic Geography" (NEG) literature has a different approach from Christaller's one. Trying to answer to the question where manufactures production locates, NEG analyzes the formation of core-periphery patterns and the dynamic of convergence or divergence between regions and cities (Krugman 1991).

To understand this phenomenon *circular causality* is considered (see Figure 2.2), observing that manufactures tend to be concentrated in large markets and markets become larger when manufactures are concentrated. In fact, *due to scale economies in product specialization*, each variety of M-goods is produced by a single firm (by using labor as the only input) which chooses its f.o.b. price monopolistically[7] (Fujita and Krugman, 1995:506, own italics). In this context, manufactured goods (M-goods) are available at a lower cost in the city, where they are produced, because of the absence of transport costs. Given nominal wages and considering preferences for variety, real income of workers in the city will be higher.

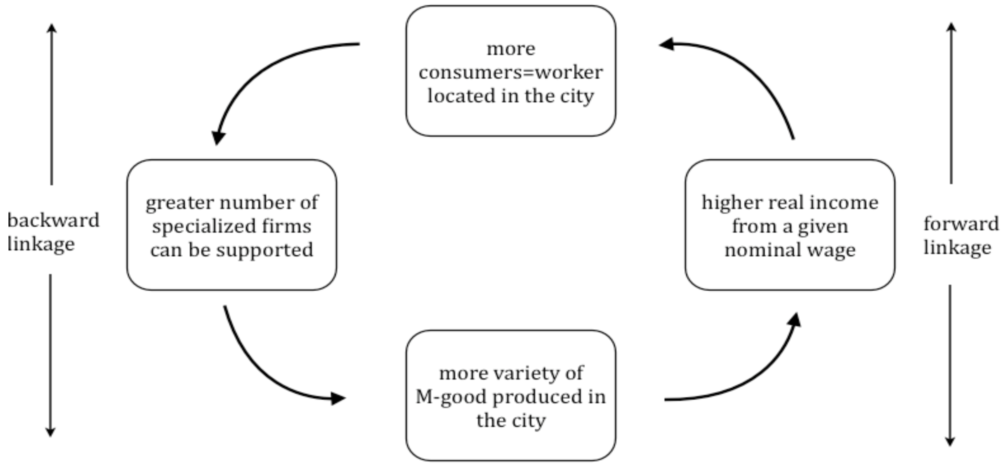
These *differences of real wages will induce workers migration to the city.* The increase in the population of workers in the city raises the demand of M-goods, boosting industrial specialization, creating more variety of M-goods, increasing market size and the utility (real wages) for workers. This creates a *circular causality among firms and workers*, where *forward linkages* (greater variety of goods increases real wages of workers) and *backward linkages* (greater number of worker or consumer increases the number of specialized firms) are considered.

If we consider an "isolated state context", as Von Thünen, the circular causality described could lead towards a total agglomeration in one city:

[7] Krugman assumes a monopolistic competition *à la* Chamberlin (1933). The specific model used is derived from the Dixit-Stiglitz one (Dixit and Stiglitz, 1977).

"A bigger city, however, requires a greater agricultural hinterland and hence a longer distance for transportation of the A-good to the city, causing diseconomies of spatial agglomeration. If the spatial agglomeration force generated through the scale of economies of M-goods production and consumption is sufficiently strong so that it overwhelms this negative effect of the expansion of the agricultural hinterland, then the isolated state will have one city only" (Fujita and Krugman 1995:507).

Figure 2.2. Krugman´s circular causality



Note:
Backward linkage - greater number of consumers support greater number of specialized firms
Forward linkage - greater variety of consumptions goods increases real income of workers

Source: Fujita and Krugman, 1995:507

Explaining convergence and divergence

This analysis becomes much more interesting in Krugman's two regions model, where the effect of agglomeration and dispersion forces on the *convergence* and *divergence* of regions is depicted[8]. The model assumes the presence of two king of goods: manufactured goods (in N differentiated varieties) and a homogeneous agricultural good.

Krugman's model want to show that agglomeration patterns between regions depends strongly on some *key parameters*, in particular the existence of scale economies in the production of differentiated varieties of manufactured goods, the preference for variety in the individual utility function, and transport costs.

[8] For Krugman (1991), the concept of convergence indicates the location of manufactures following the distribution of land, as in Lösch (1940). It implies that people is dispersed on the space or tend to be equally distributed between two regions. On the other hand, divergence indicates the unequal location of manufactures, forming central-periphery patterns and the creation of large agglomerations.

We present firstly the basic characteristics of the model and after we will introduce the existence of two different regions to understand under which conditions there will be convergence or divergence between the two areas (or cities).

Monopolistic competition in the production of manufactured goods

The first step is to understand how the production of manufactured goods happens.

Krugman assumes:

- The existence of "n" differentiated manufactures goods
- Labor is the only input in producing these goods
- The production of these goods shows scale economies given the existence of a fixed cost in labor.

Let the *production function* for each differentiated manufactured good be:

$$l_i = \alpha + \beta x_i \;\; \forall i \qquad (1)$$

where α is a fixed cost in labor and β the inverse of the marginal (and constant) productivity of labor.

Given a wage ***w*** for a worker in manufacturing, the *total Costs* for the i-th firm:

$$TC_i w l_i = w\alpha + w\beta x_i \;\; \forall i \qquad (2)$$

Marginal Costs (MC) correspond to:

$$MC_i = \frac{dTC_i}{dx_i} = w\beta \;\; \forall i \qquad (3)$$

The *Revenues* (*R*) of the firms are:

$$R_i = p_i x_i \quad \forall i \qquad (4)$$

and the *Marginal Revenue* (MR) is given by:

$$MR_i = \frac{\partial R_i}{\partial x_i} = \frac{\partial p_i}{\partial x_i} x_i + p_i = p_i \left[1 + \frac{\partial p_i}{\partial x_i}\frac{x_i}{p_i}\right] = p_i\left[1 + \frac{1}{\eta_i}\right] \quad \forall i \quad (5)$$

Where η_i is the elasticity of demand to price for good *i*.

As we will see (equation (21)) $\eta_i = -\sigma$ so marginal revenue can be written as:

$$MR_i = p_i\left(\frac{\sigma - 1}{\sigma}\right) \;\; \forall i$$

Maximizing profits implies *MR=MC*

$$p_i\left[\frac{\sigma-1}{\sigma}\right]=\beta w \text{ hence } p_i=\frac{\sigma}{\sigma-1}\beta w \quad \forall i \tag{6}$$

And zero-profit condition imply:

$p_i\, x_i = w\alpha + w\beta x_i \;\; \forall i$, that is (from (6)):

$$x_i = \frac{(\sigma-1)\alpha}{\beta} \quad \forall\, i \tag{7}$$

The labor used in the production of the i-th variety is consequently (from (7)):

$$l_i = \alpha + \beta x_i = \alpha\sigma \quad \forall i \tag{8}$$

and if we have a number n of differentiated manufacturing products, the total population of manufacturing workers will be:

$$L_M = n\, l_i = n\,\alpha\sigma \tag{9}$$

If we have the same technology for all differentiated products and a unique labor market (same wage for all workers), we have equal prices and quantities for all products.

Agricultural good

The second kind of good involved in the model is the agricultural one. It is assumed that the quantity of agricultural labor which is necessary to produce a unit of agricultural good, l_A, is equal to 1. Hence the agricultural output will be equal to the agricultural population, L_A. The price of agricultural good is the numeraire, so: $p_A = 1$.

If we normalize the total population to 1, we have:

$$L_M + L_A = 1 \tag{10}$$

As we will see below (equation (11)), given consumers' preferences, the share of the agricultural population on total population will be (1-μ) and the share of the manufacturing workers on population will be μ:

$$L_M = \mu \;\; ; \;\; L_A = (1-\mu) \tag{11}$$

$\left(1-\mu\right) = p_A\left(1-\mu\right)$ is both the agricultural population, the quantity of agricultural production, and its value.

Utility function (demand side)

Krugman model, following the Dixit-Stiglitz approach, considers a Cobb-Douglas utility function with arguments the quantity consumed of the agricultural good, C_A, and an aggregate index of the quantities consumed of the different varieties of the manufactured goods, C_M:

$$U = C_M^{\mu} C_A^{1-\mu} \qquad (12)$$

The share of income spent in the agricultural good is the equal to (1-$\boldsymbol{\mu}$) and the share spent in the aggregate group of manufactured goods is equal to $\boldsymbol{\mu}$.

C_M, *the index of consumption of manufactured goods* aggregates the **n** different varieties through a constant elasticity of substitution (CES) function:

$$C_M = \left[\sum_{i=1}^{n} c_i^{(\sigma-1)/\sigma}\right]^{\sigma/(\sigma-1)} \qquad (13)$$

The parameter **σ,** we will see, represents the elasticity of substitution between every pair of M-goods varieties; **n** is the number of potential products and ***c*** the individual consumption of each variety.

Considering budget constraints, *wages* correspond to the sum of the expenditures in both the consumption of the homogeneous A-good (with price =1) and the consumption of the **n** different varieties of M-goods, each at price $\boldsymbol{p_i}$**.** Then:

$$w = C_A + \sum p_i c_i = (1-\mu)w + \sum p_i c_i \Rightarrow \mu w = \sum p_i c_i \qquad (14)$$

Utility maximization implies both (15) and (14):

$$\frac{\partial U}{\partial c_i} - \lambda p_i = 0 \quad \forall i \qquad (15)$$

Let us call: $v = \sum_{i}^{N} c_i^{(\sigma-1)/\sigma}$ then $C_M = v^{\sigma/(\sigma-1)}$

Resolving (15):

$$\frac{\partial U}{\partial c_i} = \frac{\partial U}{\partial C_M}.\frac{\partial C_M}{\partial v}.\frac{\partial v}{\partial c_i} = \mu \frac{U}{v} c^{-1/\sigma} \quad \forall i$$

The *Marginal Rate of Substitution* (*MRS*) between two different M-goods *i* and *j* is:

$$MRS = \frac{\frac{\mu U}{v} c_i^{-1/\sigma}}{\frac{\mu U}{v} c_j^{-1/\sigma}} = \left(\frac{c_j}{c_i} \right)^{1/\sigma} \qquad (16)$$

so, the condition $MRS == \left(\frac{p_i}{p_j} \right)$ gives:

$$\frac{c_j}{c_i} = \left(\frac{p_i}{p_j} \right)^{\sigma} ; \quad \frac{c_i}{c_j} = \left(\frac{p_i}{p_j} \right)^{-\sigma} \qquad (17)$$

Finally the *elasticity of substitution* is defined by:

$$Ec_i, c_j = -\left(\frac{\partial \left(\frac{c_i}{c_j} \right)}{\partial \left(\frac{p_i}{p_j} \right)} \right) \cdot \frac{p_i / p_j}{c_i / c_j}$$

$$= \sigma . \left(\frac{p_i}{p_j} \right)^{-\sigma - 1} . \frac{p_i}{p_j} \left(\frac{p_j}{p_i} \right)^{-\sigma} = \sigma \qquad (18)$$

which, as expected, is constant and equal between each pair of varieties.

If the number n of varieties is large (assumption of a “large group monopolistic competition”), we can assume that the prices of all other varieties remain constant when a specific price, $\boldsymbol{p_i}$, varies, because the effects of this change are negligible. We can then write:

$$\mu w = \sum p_i c_i = npc_j \quad \forall \ j \qquad (19)$$

so:

$$c_j = \frac{\mu w}{np} \text{ and } c_i = p_i^{-\sigma} \frac{\mu w}{\left[np^{-(\sigma-1)} \right]} \qquad (20)$$

The term in brackets in equation (20) is a constant. Equation (20) represents the demand function for the i-th variety of the manufactured good. It is then easy to show that the elasticity of the demand of the good to a change in its price is exactly $-\sigma$:

$$\eta_i = \frac{\partial c_i}{\partial p_i}\frac{p_i}{c_i} = -\sigma \qquad (21)$$

A two region model

Given the basic characteristics described, we assume now the existence of two regions. Agriculture and manufactures are present in both regions. In particular, given the distribution of land, peasant population is divided equally between the two regions. Agricultural activities and labor are not mobile. Manufacturing activities can, instead, localize either in one or in the other region. This means that the population of workers splits between region 1 and region 2:

$$L_M = \mu = L_1 + L_2 \qquad (22)$$

and if we call f the share of manufacturing labor force located in the first region, we can write:

$$f = \frac{L_1}{\mu}\,;\; (1-f) = \frac{L_2}{\mu} \qquad (23)$$

While the trade of agricultural good has no transport costs, the transport of the varieties of manufactured goods is costly; in particular, transport costs for manufactured goods are "Samuelson's iceberg" type; which means that for each unit of manufactured good shipped only a fraction τ (< 1) will arrive; so τ is an inverse index of transport costs.

Lastly, wages in the two regions can be different.

Considering the difference of wages between the two regions, from (6) we can write:

$$p_r = \frac{\sigma}{\sigma - 1}\beta w_r \quad (r = 1,2) \qquad (24)$$

That is the varieties produced in one region have the same price, but the varieties produced in the two regions have different prices given the differences in wages. We can then write:

$$\frac{p_1}{p_2}=\frac{w_1}{w_2} \qquad (25)$$

On the contrary, the quantity produced of any variety is the same both in region 1 and in region two (the optimal quantity produced does not depend on wages: see (7)). Also the quantity of labor employed in the production of each variety is constant across regions (see (8)). This help to determine the number of varieties produced in each region given the specific population of workers:

$$n_r=\frac{L_r}{\alpha\sigma} \qquad (26)$$

and

$$\frac{n_1}{n_2}=\frac{L_1}{L_2} \qquad (27)$$

It is now possible to revive the basic question of the model. Under which conditions there will be diffusion of the activities between the two regions? Under which conditions there will be concentration of the activities in one region?

Let us define:

c_{11} the consumption of a resident in region 1 of a good produced in region 1; the price she pays , p_1 , is "f.o.b. type" that is without transport costs;

c_{12} the consumption of a resident in region 1 of a good produced in region 2; the price she pays, p_1/τ , is "c.i.f. type" and includes transport costs.

According to equation (17), which describes the optimal choice of (relative) quantities given relative prices, we have:

$$\frac{c_{11}}{c_{12}}=\left(\frac{p_1}{p_2/\tau}\right)^{-\sigma}=\left(\frac{p_1\tau}{p_2}\right)^{-\sigma}=\left(\frac{w_1\tau}{w_2}\right)^{-\sigma} \qquad (28)$$

If we denote by z_{11} the resident of region 1 ratio of expenditures on local varieties of manufactured goods over the expenditure on varieties manufactured in region 2, and by z_{12} the resident of region 2 ratio of expenditure in varieties manufactured in region 1 over the expenditure in locally manufactured varieties, we can write:

$$z_{11} = \frac{n_1\, p_1\, c_{11}}{n_2\, {}^{p_2}\!/_{\tau}\, c_{12}} \tag{29}$$

that is:

$$z_{11} = \left(\frac{L_1}{L_2}\right)\left(\frac{w_1 \tau}{w_2}\right)^{-(\sigma-1)} \tag{30}$$

and:

$$z_{12} = \frac{n_1\, {}^{p_1}\!/_{\tau}\, c_{21}}{n_2\, p_2\, c_{22}} = \left(\frac{L_1}{L_2}\right)\left(\frac{w_1}{w_2 \tau}\right)^{-(\sigma-1)} \tag{31}$$

Rearranging the expressions in (29) and (31), and aware of the fact that:

$$n_1 p_1 c_{11} + n_2 \frac{p_2}{\tau} c_{12} = \mu w_1$$

$$n_1 \frac{p_1}{\tau} c_{21} + n_2\, p_2 c_{22} = \mu w_2$$

We have:

$$\frac{z_{11}}{1+z_{11}} = \frac{n_1 p_1 c_{11}}{\mu w_1} \; ; \; \frac{z_{12}}{1+z_{12}} = \frac{n_1\, {}^{p_1}\!/_{\tau}\, c_{21}}{\mu w_2}$$
$$\frac{1}{1+z_{11}} = \frac{n_2\, {}^{p_2}\!/_{\tau}\, c_{12}}{\mu w_1} \; ; \; \frac{1}{1+z_{12}} = \frac{n_2\, p_2 c_{22}}{\mu w_2} \tag{32}$$

Equations in (32) represent the share of expenditure in region 1 varieties over the total expenditure in manufacturing goods for a worker in region 1 and region 2 respectively (first row); and the share of expenditure in region 2 varieties over the total expenditure in manufacturing goods for a worker in region 1 and region 2 respectively (second row).

If we call Y_1 the total revenue of region 1, $\mu Y_1 \frac{z_{11}}{1+z_{11}}$ is, for instance, the total expenditure of region 1 residents on region 1 varieties.

Then, multiplying the unitary expenses of equation (32) for the total income of the two region (for the part $\boldsymbol{\mu}$ used to buy manufacturing goods), we obtain the total value demanded for varieties of region 1 and region 2 from the population of the whole system. This value (given the zero-profit condition) must be equal to the sum of the wages of the workers of each region (see equations (33) and (34)).

$$w_1 L_1 = \mu \left[\left(\frac{z_{11}}{1+z_{11}} \right) Y_1 + \left(\frac{z_{12}}{1+z_{12}} \right) Y_2 \right] \quad (33)$$

$$w_2 L_2 = \mu \left[\left(\frac{1}{1+z_{11}} \right) Y_1 + \left(\frac{1}{1+z_{12}} \right) Y_2 \right] \quad (34)$$

Where the total income of the two regions, Y_1 and Y_2, is:

$$Y_1 = \frac{1-\mu}{2} + w_1 L_1 \quad \text{and} \quad Y_2 = \frac{1-\mu}{2} + w_2 L_2 \quad (35)$$

Real wages, convergence or divergence

The decision of a specific worker to locate in one or another region depends not on nominal wages, but on real ones. To estimate real wages we have to define the price index of manufacturing varieties bought by a worker of region 1 and of region 2. These price indexes (P_1, P_2) depend on the share of workers in the two regions (*f* and (1-*f*) respectively), as equations (36) an(37) show.

$$P_1 = \left[f w_1^{-(\sigma-1)} + (1-f) \left(\frac{w_2}{\tau} \right)^{-(\sigma-1)} \right]^{-1/(\sigma-1)} \quad (36)$$

$$P_2 = \left[f \left(\frac{w_1}{\tau} \right)^{-(\sigma-1)} + (1-f) w_2^{-(\sigma-1)} \right]^{-1/(\sigma-1)} \quad (37)$$

Finally we obtain that the real wages of workers in region 1 and 2 are:

$$\omega_1 = w_1 P_1^{-\mu} \quad (38)$$

$$\omega_2 = w_2 P_2^{-\mu} \quad (39)$$

The value of real wages is difficult to determine analytically (Krugman, 1991:493); to solve this difficulty, Krugman uses simulations, giving specific values to the endogenous variables. For instance, if we assume the following values:

σ = 4 ; μ = 0.3 ; τ = 0.5 (high transport costs)

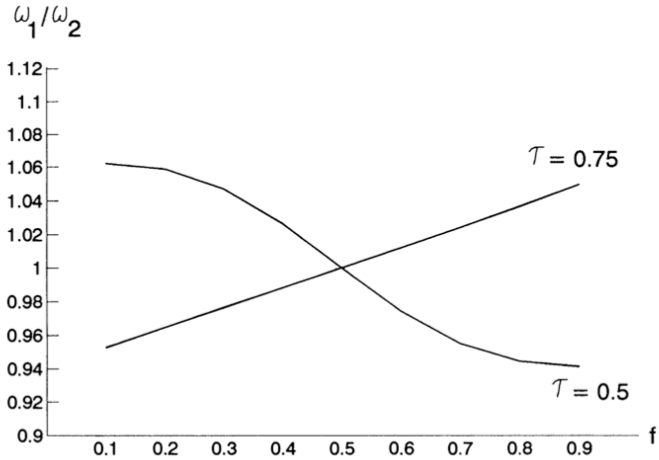
the results for the real wages ratio, ω_1 / ω_2, are shown by the negatively sloped line in Figure 2.3. This means that with the increase of the share of region 1 workers, the relative real wage decreases. In this case we should expect regional convergence, that is a distribution of manufacturing activities between the two regions (f = 0.5). The high transport costs make manufacture follow the distribution of agricultural population (that is equally distributed among the regions). The force that acts toward convergence, the competition for local peasants market, dominates.

If we assume instead these other values:

σ=4 ; μ= 0.3 ; τ=0.75 (low transport costs)

the results for the real wages ratio are shown by the positively sloped line in Figure 2.3.

Figure 2.3. Wages, urban agglomeration and transport costs. Krugman (1991)



Source: Krugman 1991, p. 493

In this case the two forces acting towards divergence, the home market effect (the circular causality) and the derived price index effect, given relatively low transport costs, push toward the localization of all manufacturing activities in the same region, creating a core-periphery situation

2.3.4. The Housing Factor: The Contribution of Helpman

We have already observed the importance of transport costs, preference for variety and increasing returns in the production and consumption of M-goods to explain agglomeration and dispersion forces. Now we introduce a different perspective, where the housing parameter becomes a key pecuniary externalities in the process of agglomeration.

Helpman (1995) proposed a model using the same framework of Krugman (1991) but replacing the role of agriculture (A-good) with the supply of housing and observes how transport costs shape agglomeration. Considering the similarities between the models, we do not present in detail the work of Helpman; therefore we only point out the differences with Krugman's main contribution.

In Helpman, the agglomeration and dispersion forces are organized as follow:

-*Main centrifugal force (housing)*: The attraction of more workers increases the demand of housing. As a consequence, the cost of living increases, reducing real wages. This fact reduces the utility of workers, causing migration to other regions with lower cost of housing.

-*Main centripetal force (economies of scale and preference for variety):* Industrial specialization and economies of scale allow greater variety of M-goods, which are available at a lower cost in the city due to lower transport costs; higher real wages attract workers.

Below, we present a comparison between the assumptions of Krugman and Helpman, to identify the main differences between the two models.

Table 2.2. Comparison between Krugman (1991) and Helpman (1995) assumptions

Assumptions in Krugman 1991	**Assumptions in Helpman 1995**
- Differentiated manufactured goods	- Differentiated manufactured goods
- Homogeneous agricultural goods	- Homogeneous housing
- Peasant do not move between regions; workers move	-Workers move between regions; peasants are not present
- Homogeneous agricultural goods are freely traded across regions	- Housing services are not traded across regions; each region has a fixed housing stock
- Residents in region i spend their income in agricultural goods and manufacturing varieties produced in both regions.	- Workers income is spent in housing and in both locally produced and imported manufactured goods.

Source: Our elaboration

In Helpman's model, the utility function, as in Krugman, is a Cobb Douglas with arguments housing consumption (h) and the consumption index of differentiated manufacture goods (d), similar to Krugman's C_M :

$$u = h^{\beta} d^{1-\beta}$$

β is hence the share of expenditure in housing and (1-β) the share of expenditure in different varieties of manufactured goods. Utility depends on housing consumption and the consumption of differentiated manufactured goods.

The aggregate function of manufactured goods is defined by Helpman with the following CES:

$$d = \left[\int_0^N x(j)^{\alpha} dj \right]^{1/\alpha}, 0 < \alpha < 1,$$

where *x(j)* corresponds to the consumption of the manufactured goods of brand *j.*

It is easy to prove that $\varepsilon = 1/(1-\alpha)$ is the constant elasticity of substitution between the varieties of manufactured goods.

Finally, if individuals (and firms) decide to locate in the "non-urban" area (where costs of housing are lower) they have to bear a transport cost measured by the reciprocal of τ (transport costs for manufactured goods are Samuelson's "iceberg" type).

Helpman considers different stable equilibria combining three dimension: the cost of Housing consumption; the preference for variety and transport costs.

In fact, a low β means that centrifugal forces linked to housing costs are also low.

A low ε means a strong preference for variety, hence a strong centripetal force.

The parameter βε combines the two dynamics, the expenditure for housing, measured by the β parameter (centrifugal force) and the elasticity of substitution between manufacturing goods (centripetal force), captured by ε.

A value of βε > 1 indicates that individuals do not care much on M-goods variety (high value of ε) and the demand for housing is high (high β); therefore individuals will tend to move towards the region with less population because of lower costs of housing. This is valid in a context of both low and high transport costs.

The situation is different when βε < 1; in this case individuals care much about M-good variety (low value of ε) and the demand for housing is low (low β). In this context if transport cost are zero or low, workers can commute; however if transport cost are high, individuals will necessarily move to the region with more M-goods variety and agglomeration will boost. This is a main difference with Krugman model:

> "While in Krugman's framework low transport costs lead to extreme agglomerations and higher transport costs may reduce the degree of agglomeration, in my framework low transport costs lead to little agglomeration while higher transport costs may lead to larger agglomerations." (Helpman, 1995:24).

In synthesis we have (see also table 2.3):

Low transport costs scenario

Given βε>1 : high demand of housing and high elasticity of manufactured goods, with very low transport costs, we expect *regional convergence*.

Given βε<1 : low demand of housing and low elasticity of manufactured goods, with *very low transport costs*, we expect *regional convergence*.

High transport costs scenario

Given βε>1 : high demand of housing and high elasticity of manufactured goods, with very high transport costs, we expect *regional convergence*.

Given βε<1 : low demand of housing and low elasticity of manufactured goods, with very high transport costs, we expect *regional divergence*.

Table 2.3. Regional convergence and divergence in Helpman

Parameter βε	τ zero or low	τ high or unlimited
βε>1	Convergence	Convergence
βε<1	Convergence	**Divergence**

Convergence: indicates population equally dispersed between the two regions.
Divergence: indicates population concentrated in one region.
Source: Our elaboration

For Helpman these dynamics are possible due to the strong pecuniary externalities that are linked to housing. In Krugman, only one economic sector exerts strong pecuniary externalities (manufacturing) which creates real wage differential resulting in strong centripetal forces (a dynamic that is enhanced by the presence of low transport cost). In Helpman we have two factors that exert strong pecuniary externalities, therefore different equilibria are possible in the presence of high transport costs.

The contribution of Helpman, is interesting to understand why some cities continue to growth, in spite of their increasing congestion. In fact, particularly among developing countries, despite the presence of significant high transport costs, the main city size does not decline. In this sense, the consideration of the housing variable is relevant because if the cost of housing is relatively low, we will observe an increase of the agglomeration, which is coherent with the fact that several emerging mega cities are characterized by the presence of "lower cost housing" or shanty towns.

2.3.5. The Raise of Megalopolis

Von Thünen (1826) considered in his urban economic model, the spatial location of different activities in an isolated city or region. Krugman (1991) analyzed urban agglomerations introducing the effects of preference for variety and transport costs, in imperfect competition markets, in shaping convergence or divergence between regions. Helpman (1995) underlined the role of housing which help us to understand how agglomerations can occur also with high transport costs and how (due to low housing costs) we can expect the springing up of slums in Mega cities. However, agglomerations are usually immerse in dense and complex urban systems were large cities interact with several other cities of different size. That is what we analyze now, the raising of megalopolis in the definition of Mori (1997).

According to Mori, megalopolis

> "...consists [in a] large core of cities that are linked by an *industrial belt*, or a *continuum of cities.* Megalopolis can be found, for example, on the Atlantic seaboard of the United States stretching from Boston to Washington DC, via New York; on the Silicon Glen between Glasgow and Edinburgh; and on the Pacific coast of Japan from Tokyo to Osaka. Megalopolises also form over national borders. Notables examples can be found on the so-called "Blue Banana" crossing from Brussels to Zurich, to Munich via Frankfurt and Stuttgart, and over the United States-Mexico border between San Diego and Tijuana" (Mori, 1997:134).

Mori's megalopolis starts in a scenario of high transport costs and low levels of agglomerations In this process he identifies five stages[9] that have been schematized in Figure 2.4. (see below).

- Stage 1 (S1) is characterized by high transport costs which induce industries to be located close to small urban centers following the setting of arable land. The urban structure is conformed by several small cities distributed in the space.

- Stage 2 (S2) emerges when transport cost begin to decrease. In this scenario firms can continue to serve the hinterland due to increasing mobility; therefore firms look for location economies and tend to agglomerate in a reduced number of larger cities.

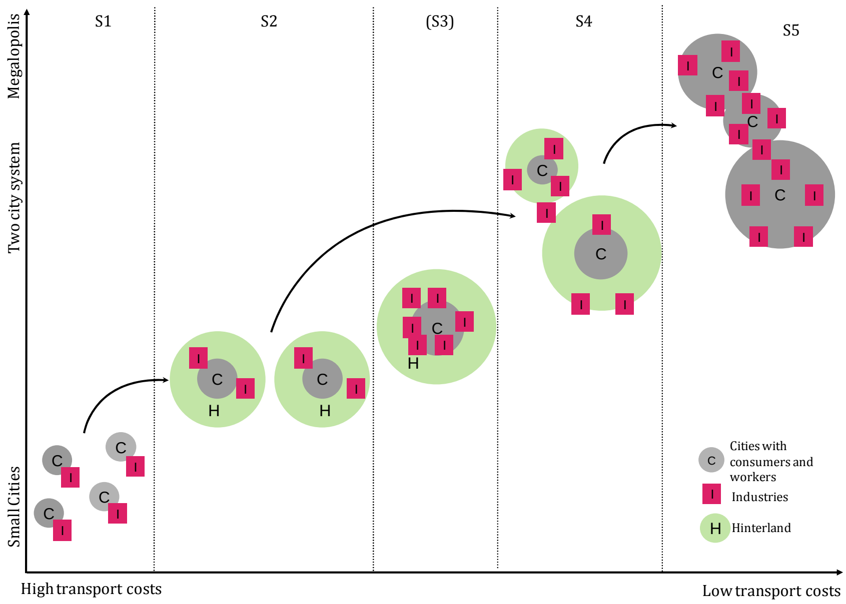
[9] These stages are not directly defined by Mori; he only describes the process. In order to facilitate the comprehension we introduce the different stages that are implicit in his analysis.

- (Stage 3): Transport costs continue to decline. Firms will move to more central locations looking for greater agglomeration economies, so the number of urban centers continue to decline. Nevertheless, according to Mori, this process could be contrasted by a new phenomenon (S4).

- Stage 4 (S4): Transport costs will continue to decline intensifying the mobility to acquire M-goods. Nonetheless, the costs of transport of A-goods are usually cheaper in the hinterlands, so consumers prefer to move away from the large city. This implies that "wages rate at each location tend to reflect the price difference of the A-good more than that of M-goods, which in turn implies that the wage rate decreases toward the A-hinterland" (Mori, 1997:135). Firms will look for a location that present lower wages; as a consequence firms move to hinterland. This process is followed by others firms which continue to look for agglomeration economies. This fact induces the creation of a new city located relatively close to the main city, but avoiding the "*urban shadow" or the area where the competition between manufacturing firms is intense*. This new city continues to growth until its wage advantages vanish. Now two cities (old and new) exist with a relatively low distance between them.

- Stage 5 (S5): Firms will tend to exploit the advantages of the area that lay between the urban shadows of the two cities, therefore firms start to be located in that corridor. Furthermore, with reduced transport cost, the new hinterlands between the two cities offers new wages advantages, consequently a third city emerge; the agricultural land between the old and the new city disappears. Now we have a Megalopolis.

Figure 2.4. The Process of Megalopolis formation according Mori (1997)



Source: Our elaboration based on Mori (1997)

Mori's idea contributed to understand the drivers and processes that lead to the emergence of large agglomerations. According to him, the main factors that explain megalopolis, as in Krugman (1991), are pecuniary externalities:

- *Increasing returns to scale* are a key *explanation* of why firms agglomerate.
- *Transport costs* (of both A-goods and M-goods) are the main drivers of agglomeration and dispersion forces.
- Spatial real *wage rates differentials* because of price differences between M-goods and A-goods (due to transport costs), drive the choice of firms and individuals.

It is interesting to note that for Mori low transport costs in large agglomerations will tend to disperse firms and consumers out of the urban shadow, but this decrease on transport costs does not guarantee strong centrifugal forces. He states that the combination of agglomeration and dispersion forces among large agglomerations tends to create megalopolis. Indeed, dispersion forces operate, but only in a short range, attached to the main city, where new cities spring up in the surrounding area.

This process creates increasing centripetal forces towards megalopolis, confirming that low transport cost not always decline agglomerations. Large agglomerations are a complex "city system" where old and new cities interact through an *industrial belt* creating a unique large and strong urban area.

Mori's model goes beyond the two regions or city dynamics; it introduces other spatial elements where low transport cost give the possibility of exploiting non costly land and labor, taking the advantages of location near old cities and avoiding urban shadows.

2.4. Urban concentration and Economic Development

Following the idea of Kuznets (1955) and Williamson (1963), Wheaton and Shishido (1981) studied the relation between the level of economic development and urban concentration. They argue that this relation follows an inverted U-shape. At the beginning of the process of economic development, urban concentration increases and at more advanced levels of development, declines.

They define urban concentration as the number of urban centers (cities) in relation to the market size, where market size is the dimension of the economy measured by its non agricultural GDP and compare this relation with the attained degree of development, measured by the non agricultural GDP per capita.

Urban concentration is driven firstly by the presence of scale economies. Wheaton and Shishido define scale economies not as something measured in an aggregate production function, but "rather to the presence of increasing returns in site-specific or plant production" (p. 23). Scale economies grow with development and an indicator of such economies is the capital intensity of productive processes; with growth, capital intensity (and the associated fixed costs) arise and need a larger market to be exploited. This is why their "normal" environment is an urban center, urbanization. The "economic dimension" of each urban center is positively associated, as a consequence, with the level of economic development (measured, as said before, by the per capita non agricultural GDP).

> "Generalizing (…) this approach, it might be said that, at the more advanced stages of development, the efficient level of output for an entire urban area is greater, due to the presence of capital intensification and scale effects" (p. 23).

The second element that shapes urban concentration is the overall size of the economy and its dispersion. Spatial diffusion of markets and the consequent transport costs can contrast the effect of scale economies and give raise to a higher decentralization of the urban system:

> "…greater scale economies should result in more urban concentration, while larger and/or more disperse market should lead to urban decentralization" (Wheaton and Shishido, 1981:22)

The urban concentration idea of Wheaton and Shishido evidently does not imply the presence of one mega city or an extremely hierarchical urban structure. Urban concentration could be more akin to a "Christaller-like" urban system, where manufacturing requires to be diffused in several urban centers to allow a reduction of transport costs.

> "…urban concentration is the size of a country's potential market. If the efficient level of production for a given center is fixed, a larger national market clearly encourages a greater number of such production centers to be established in order to reduce transport costs " (Wheaton and Shishido, 1981:22)

As we will see in the empirical application of the model, Wheaton and Shishido consider also the *land characteristics*, play a key role in shaping a spatial diffusion of markets; and, finally, administrative and political factors. According to the authors, governments' power plays a crucial role in determining firms and peoples location decision, hence countries with decentralized political authorities will tend to present a more decentralized urban setting (Wheaton and Shishido 1981:26).

Summarizing, the urban structure is affected by four elements: capital intensity (linked to economic development), transport costs, land characteristics and political elements. Concentration or decentralization of the urban system will depend on how these elements interact.

Assumptions of the model:

The indicator that Wheaton and Shishido use to measure the importance of scale economies is an economic development indicator: the per capita Non-agriculture Gross National Product (that we will call G_{CAP}). For the authors there is a relation between this indicator and the efficient "economic dimension" of an urban center: the higher the G_{CAP}, the higher the efficient economic dimension of an urban center. This relation follows a S-shaped relation (see figure 2.6).

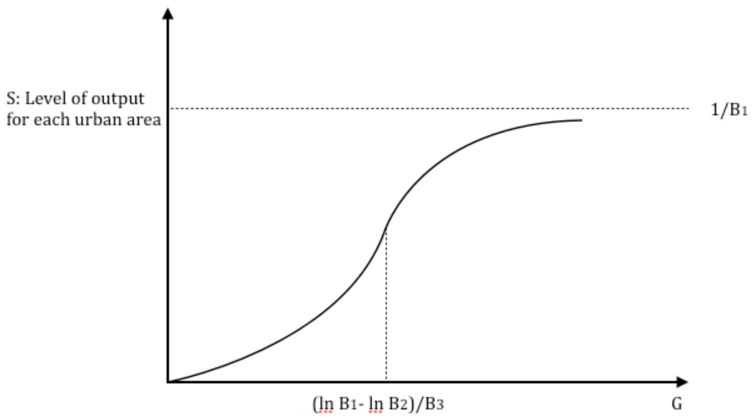
A growth in G_{CAP} increases the efficient dimension (variable S) of the urban area, because the higher capital intensity requires a greater market size. This process is followed by a "capital saturation", implying that the urban efficient dimension will continue to growth but at a lower rate. The relation between the "economic dimension" of an urban centre and the level of development of the economy in which the city is situated (a measure of capital intensity), is measured by the following logistic function:

$$S = 1/(B_1 + B_2 e^{B_3 G_{CAP}}) \quad (1)$$

Were: $B_1, B_2 > 0$; $B_3 < 0$

It is easy to see that: $\lim_{G_{CAP} \to \infty} S = \frac{1}{B_1}$ (see figure 2.5)

Figure 2.5. Slowdown of urban efficiency



Source:Wheaton and Shishido (1981)

Let us have: $v = (B_1 + B_2 e^{B_3 G_{CAP}})$ hence: $S = v^{-1}$

$$\frac{\partial S}{\partial G_{CAP}} = \frac{\partial S}{\partial v}\frac{\partial v}{\partial G_{CAP}} = \frac{-B_2\, B_3\, e^{B_3 G_{CAP}}}{v^2} > 0 \qquad (2)$$

The dimension of a urban centre is increasing in the level of (non agricultural) GDP per capita, with a higher rate till a saddle point in the function and after with a diminishing rate:

$$\lim_{G_{CAP}\to\infty} \frac{-B_2\, B_3\, e^{B_3 G_{CAP}}}{v^2} = 0 \qquad (3)$$

The saddle point (change from a growing to a diminishing rate of growth in the relation between G_{CAP} and S), is the point in which the second derivative of S on G_{CAP} equals 0.

Let $$Z = \frac{\partial S}{\partial G_{CAP}} = \frac{-B_2\, B_3\, e^{B_3 G_{CAP}}}{v^2} = \frac{h(G_{CAP})}{v^2} \qquad (4)$$

then

$$\frac{\partial Z}{\partial G_{CAP}} = \frac{\partial h(G_{CAP})}{\partial G_{CAP}} v^{-2} + h(G_{CAP}) \frac{\partial v^{-2}}{\partial v}\frac{\partial v}{\partial G_{CAP}} \qquad (5)$$
$$= -B_2 B_3^{\,2} e^{B_3 G_{CAP}}\, v^{-2} + 2(B_2 B_3\, e^{B_3 G_{CAP}})^2 v^{-3}$$

This derivative is equal to 0 when:

$$B_2 e^{B_3 G_{CAP}} = B_1 \Rightarrow G_{CAP} = \frac{\ln B_1 - \ln B_2}{B_3} \qquad (6)$$

(where, evidently, $B_2 > B_1$ for a positive G_{CAP})

Defined the level of each urban center, given the development level of the country, it is possible to measure urban concentration (the number of urban centers that the economy can efficiently contain). For this they use an indicator that is a proxy of an inverse Herfindahl index (1/H). In the authors' words:

> "If the efficient level of production for a given center is fixed, a larger national market clearly encourages a greater number of such production centers to be established in order to reduce transportation costs. If exports and imports roughly balance, then a country's potential market may be approximately measured by its total nonagricultural GNP. An important question arises, however, about how exactly to relate market size, and the efficient level of city production, to the degree of urban concentration. (…) it seems possible to hypothesize that the number of production centers, or degree of urban decentralization in a country, should simply be the country's total market size divided by

the efficient size of production for each center. If the number of production centers is size corrected, as it should be, then the inverse of the H index becomes the appropriate measure of decentralization" (p. 24)

$$1/H = GNP/S = GNP(B_1 + B_2 e^{B_3 Gcap}) \qquad (7)$$

Given that till the saddle point the efficient "economic size" of an urban center grows more quickly than the total economic dimension of the national market, and after the relative change will favor economic growth and not the growth of urban centers, we expect a U-shaped relationship between the index of deconcentration (1/H) and the level of GNP (or the level of G_{CAP}).

When the country begin a process of economic change, we then expect increasing levels of urban concentration; however when scale economies have reached a sufficient urban size to be exploited, decentralization increases.

In the empirical estimation of the model, the authors introduce two other variables that affect the urban decentralization levels: land and government characteristics. As regards land, they consider the area of arable land, and as regards government they consider the ratio of central government expenditure on total government expenditures as a proxy of "power concentration".

So the model they estimate is the following:

$$1/H = GNP(B_1 + B_2 e^{B_3 Gcap}) + B_4 \ln(AREA) + B_5 GOV \qquad (8)$$

Where:

1/H: Index of urban decentralization

GNP Non-agriculture Gross National Product

Gcap: Non-agriculture Gross National Product per Capita

B1, B2, B3 where B1,B2>0 and B3<0

AREA: Area of arable land

GOV: Ratio of central government expenditures on total government expenditures

Summarizing:

- the growth in GNP (all other variables being constant) increases urban decentralization, because a greater market size implies more urban centers to reduce transport costs;

- the take-off of a development process (initial growth of G_{CAP}) increases urban concentration; a mature development favors decentralization;

- geographical factors such as arable land should have a positive impact on urban decentralization. Distribution of people will follow distribution of land. If arable land is well diffused, so will be for urban areas;

- finally, political centralism will affect agglomeration patterns. If the ratio of central government expenditures on national government expenditures is high (centralism), less urban decentralization is expected.

Equation (8) has been estimated by Wheaton and Shishido by minimizing the sum of squared residuals through a nonlinear programming algorithm.

The results of the estimation procedure, in the specification containing all the variables described (see Table 2.4), confirmed the expected signs of the coefficient. All the variables have a good level of significance, except for the "Government" variable. In a subsequent linear specification (that we do not report here), Wheaton and Shishido found a significant value of the variable "Government", but the variables GNP and G_{CAP} loose significance.

Table 2.4. Expected signs of the regression's parameters on urban descentralization

B1	B2	B3	B4	B5
+	+	-	+	-

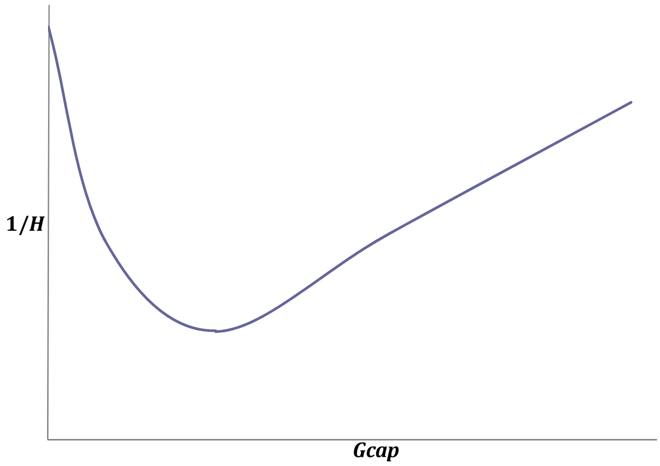
Regression results	*N*	B1	B2	B3	B4	B5	R^2
	31	.000015	.0012	-.0032	2.17	-.043	.81
		(3.34)	(6.2)	(-3.18)	(3.26)	(-.98)	

Model: $1/H = GNP(B_1 + B_2 e^{B_3 Gcap}) + B_4 \ln(AREA) + B_5 GOV$

Source: Our elaboration based of Wheaton and Shishido (1981)

Using the results of the authors' estimation we have calculated (coeteris paribus) the relation between the level of development (G_{CAP}) and decentralization (1/H), finding the expected U-shape relationship (see figure 2.6). According the model it is expected that when Gcap approximates US$ 2,000 the urban concentration will begin to decline.

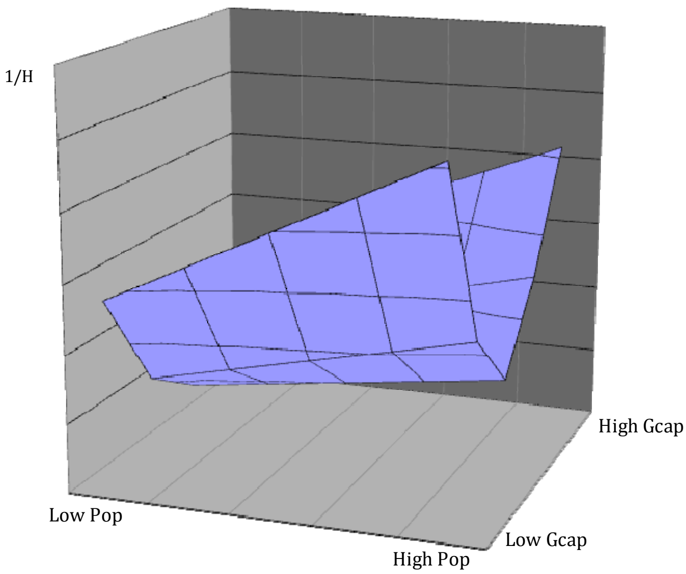
Figure 2.6. U-shape relationship between Gcap and 1/H.



Source: Our elaboration based on Wheaton and Shishido (1981)

However, which would be the case if a country expands only its GNP, but not enough its Gcap? This question implies that population growth is the dominant factor. As consequence (see Figure 2.7) the urban structure will tend to have a higher 1/H; hence we expect lower urban concentration.

Figure 2.7. U-shape relationship between urban concentration, size of population and Gcap



2.5. The Role of Politics and Other Key Variables on Agglomeration

As it has been observed above, the political factor is important to assess agglomerations patterns. This factor can be analyzed considering either the type of political regime or the particular policies that are applied. The former take into consideration the way in which authorities are elected (i.e. democracy) among other institutional matters about the way in which a country is ruled, the latter regards the specific policies that a government apply, such as trade policies. These aspects are now analyzed considering the contribution of Krugman and Livas (1992), Ades and Glaeser (1995) and Davis and Henderson (2003), studies that are among the most relevant on how political and policy factors shape agglomeration.

2.5.1. Trade Policy and Primacy

Krugman and Livas (1992) propose a theoretical model whose aim is to describe large agglomerations in the third world, where emerging mega-cities are like "Romes without Empires" (Bairoch,1988).

Considering the case of Mexico, Krugman and Livas suggest that industrial policy, in particular import substitution, have contributed to shape megapolis in the third world. Protectionist trade policies, increasing trade tariffs, create relevant Effective Rates of Protection (ERP)[10], both negative and positive, which exert important distortions in the economy. In the first case (negative ERP), tariffs on imported intermediate goods increases the cost of production for firms that use these goods as an input in their production or increase the cost of capital goods. In the second case (positive ERP) high tariff increases artificially market barriers, enhancing monopolistic competition.

These processes lower firms' productivity and their possibility to participate in international markets. Moreover, the increasing monopolistic competition makes companies more focused in the national market. However this is only a part of the story, because it does not explain well the link between import substitution and main cities growth, especially the growth of large agglomerations with high congestion costs.

The main underlying reason of this growth is the relation between economies of scale, forward linkages (variety of consumption) and backward linkages (firms specialization).

---

[10] The Effective Rate of Protection (ERP) measures the protection provided to an industry by the entire structure of tariffs, taking into account the effects of tariffs on inputs as well as on outputs. Letting b_{ij} be the share of input *i* in the value of output *j*, and t_i be the tariff on good *i*. Then the ERP of industry *j* corresponds to $ERPj = (t_j - \Sigma_i b_{ij} t_i)/(1 - \Sigma_i b_{ij})$ (Deardorffs' Glossary of International Economic). Example: if the tariff of imported shoes is 25% and the tariff of imported leather is 50%. Assuming that the country has leather production deficits and that leather represents 75% of the shoes' inputs, the effective rate of protection on the leather industry is (0,25-(0,75*0.5))/(1-0,75)= -0,5.

If a firms' manufacturing products are mainly exported and their inputs are mainly imported, firms would avoid being located in congested urban areas, where wages and land prices are higher than in hinterland. In this case, both backward and linkages are weak, because most of manufacturing goods are sold abroad and most inputs are bought abroad. However the story is different if most trade activities take place is the same location; hence the presence of strong backward and forward linkages creates circular causality or self-reinforcing processes of agglomeration as Fujita and Krugman (1995) remark.

In this context a protectionist trade policy is linked with main city agglomeration, due to the fact that firms will locate in the main city, where forward and backward linkages are stronger. Consequently, manufactures and workers will migrate to the main city, in spite of the presence of large congestion costs.

In a relatively closed economy, the Krugman's linkages are strong enough to create a mega-city in which the centripetal forces continue to be reinforced by circular causality.

Synthesis of the model

Centripetal forces arise from to the interaction of economies of scale, market size and transport costs, in other words the presence of backward and forward linkages. On the other hand, centrifugal forces are given by urban congestion (commuting costs and land rents).

The assumptions of the model consider the presence of three locations, the first two are domestic location, or the typical two regions of Krugman (1991); and the third location is the "rest of the world". Labor is the only production factor which is mobile between the two domestic locations; international labor mobility is not considered.

There is preference for variety in the consumption of the M-goods (measured by σ). Workers are endowed with a unit of labor but if they work not in the residence location, a part of the labor time will be used for commuting and a share of time labor less than 1 will be used in productive activities.

If a good is shipped from location 1 to location 2 (or vice versa) only a fraction $1/\tau$ will arrive Sammuelson "iceberg" costs (please note that here τ must be "> 1", which represents the reciprocal of the variable τ in the basic Krugman's model); τ according to Krugman and Livas represents "natural" transport cost linked to distance.

Shipping from location "0" to locations "1" or "2" causes that only a fraction 1/ρ will arrive (ρ>1), where ρ represent both transport costs and the artificial trade barriers. A high ρ means a "closed" economy.

As in Krugman (1991), wage differentials between location 1 and 2 define the location decision of population. Main hints of the model are summarized in Table 2.5, where it is assumed, for all cases, the presence of high preference for variety in the consumption of M-goods (a sufficiently low σ)as key agglomeration force.

Table 2.5. The effect of openness and closeness on agglomerations

Economic openness	**Transport cost**	**Agglomeration pattern**
Rate of protection between locatation 0 (abroad) and location 1 and 2 (national market); due the presence of distance and tariffs.	Transport cost between location 1 and 2. This affect wages working as centripetal or centrifugal force due the presence of M-goods variety.	Regional convergence of regional divergence due to wages differentials between location 1 and 2
Closed (high ρ)	Low (low τ)	Strong Divergence
Closed (high ρ)	High (high τ)	Divergence
Open (low ρ)	High (high τ)	Strong Convergence
Open (low ρ)	Low (low τ)	Convergence

Source: Our elaboration based on Elizondo and Krugman (1992)

In the model, regional convergence (workers equally dispersed between location 1 and 2) and regional divergence are notably affected by artificial trade barriers or "*ρ*".

Considering the presence of high preference of M-goods varieties, if transport costs are low (high 1/τ, that is low τ), we expect the presence of high wage differentials between location 1 and 2, hence a strong regional divergence will take place. This agglomeration increase negative pecuniary externalities, however positive ones remain stronger because "backward and forward linkages played a major role in overcoming the disadvantages of high rents, wages, congestion and pollution" (Krugman and Livas, 1992:5). As a consequence, we expect regional divergence (agglomeration).

Also if *"τ"* is high, still will workers move to the location with stronger wage differential (location with higher M-good variety). Increasing congestion will affect wages and profits but not enough to overcome agglomeration forces, due to stronger backward and forward linkages in one location; hence we still expect regional divergence.

The situation is different if we are in an open economy (low "*ρ*"); in this case backward and forward linkages are low because most of outputs are inputs are traded abroad, and transport cost will work as a centrifugal force generating convergence: strong, if transport cost are high, but remaining also with low transport costs.

2.5.2. The Contributions of Ades and Glaeser

One of the most cited studies on city primacy is "Trade and Circuses" of Ades and Glaeser (1995), who explain "urban giants" considering economic, demographic, geographic and political variables. A relevant finding of their work is the analysis of the effect of the political regime on primacy, showing that the economic factor -or economic determinism as Arthur (1988) called it- is not sufficient to explain large primacy rates.

The authors acknowledge that political weakness, and its related power concentration, affects main cities sizes, which usually are capital cities. In this sense, the effects of policy on agglomeration are linked to spatial variables.

Ades and Glaeser consider that weak democracies cannot exert the rule of law on all the national territory; consequently political rights tend to diminish in hinterlands. This fact attracts citizens to centers of powers for several reasons. Weak democracies tend to concentrate economic resources, which attracts "rent-seekers" and lobbyists to the capital. Secondly, geographic distances tend to reduce information flows between the main city and the hinterland; hence control of bribes becomes more difficult. Moreover, spatial proximity or remoteness increases or decreases political influence; as a consequence riots and revolts have a stronger influence if take place in the capital city rather than in hinterlands.

These elements induce weak democracies to maximize their survival possibilities through a mix of policies that, from one side, should benefit their electorate, and from the other should reduce the effect of revolts. Considering that spatial proximity increase political influence, the government would benefit people closer to the political center trying to improve their wages through the reduction of taxation[11].

To explain this process the following model is proposed. Two locations are considered: the main city or capital city and the hinterland. Migration from hinterland to the capital is costless. Total population of the country is standardized to one and taxes vary across space by the reasons explained above. Wages depend negatively on the levels of population due to the presence of congestion costs.

[11] According the authors, "…the spatial structure of taxation chosen by a government facing legal political pressure from the electorate and revolutionary political pressure from mobs in the capital city" (Ades and Glaeser 1995:199)

Table 2.6. Variables in the Ades and Glaeser's 1995 model

W_i:	wages in region i; where i=1,2
N:	population in central city (total population is normalized to 1)
τ_1:	tax level in capital city
τ_2:	tax level in hinterland or countryside
$rR(\tau_1)$:	Probability of a successful violent revolt in capital city, where r captures the propensity to revolt
$eE(\tau_2)$:	Probability of successful electoral change of government, where e captures the power of the electorate
V:	parameter that indicates the value of survival for the regime

The population in the central city depends on the tax differential between capital city and the hinterland. Then, the *population function* is

$$N = N(\tau_2 - \tau_1) \tag{1}$$

Gross wages depends on the level of population (due to commuting and housing costs); net wages depend on gross wages and the level of taxation. Therefore net wages are:

$W_1(N) - \tau_1$ in the main city and $W_2(1-N) - \tau_2$ in the hinterland.

As migration is costless, the equilibrium in the two labor markets implies:

$$W_1(N) - \tau_1 = W_2(1-N) - \tau_2$$

The probability for the government to survive depends, negatively, on the probability of both riots in the main city and elections that can change the parties in power. The probability of adverse elections for the government is linked to the level of taxation in the hinterland, and the probability of urban riots is linked to taxation in the central city. This probability is therefore:

$$1 - rR(\tau_1) - eE(\tau_2) \tag{2}$$

The government then will choose the levels of τ_1 and τ_2 to maximize *Z*, where:

$$Z = (1 - rR(\tau_1) - eE(\tau_2))V + \tau_1 N(\tau_2 - \tau_1) + \tau_2(1 - N(\tau_2 - \tau_1)) \tag{3}$$

The first order conditions are described by equations (4) and (5):

$$\frac{\partial Z}{\partial \tau_1} = -rV\frac{\partial R}{\partial \tau_1} + N(\tau_2 - \tau_1) + \tau_1 \frac{\partial N}{\partial(\tau_2 - \tau_1)}.(-1) - \tau_2 \frac{\partial N}{\partial(\tau_2 - \tau_1)}(-1) = 0 \tag{4}$$

That is:

$$\frac{\partial Z}{\partial \tau_1} = -rV\frac{\partial R}{\partial \tau_1} + N(\tau_2 - \tau_1) + \frac{\partial N}{\partial(\tau_2 - \tau_1)}(\tau_2 - \tau_1) = 0 \qquad (4b)$$

$$\frac{\partial Z}{\partial \tau_2} = -eV\frac{\partial E}{\partial \tau_2} + \tau_1\frac{\partial N}{\partial(\tau_2 - \tau_1)} + 1 - N(\tau_2 - \tau_1) - \tau_2\frac{\partial N}{\partial(\tau_2 - \tau_1)} = 0 \qquad (5)$$

That is

$$\frac{\partial Z}{\partial \tau_2} = -eV\frac{\partial E}{\partial \tau_2} + 1 - N(\tau_2 - \tau_1) - \frac{\partial N}{\partial(\tau_2 - \tau_1)}(\tau_2 - \tau_1) = 0 \qquad (5b)$$

If we assume linearity of N in τ_1 and τ_2 and a quadratic form for the probability of survival function (as Ades and Glaeser do), we have:

$$N = \frac{1}{4} + \frac{1}{4}(\tau_2 - \tau_1) \quad \text{(Max N=1/2, if } \tau_2 = 100\% \text{ and } \tau_1 = 0\%\text{)} \qquad (6)$$

And the quadratic function (in τ_1 and τ_2) of the probability of surviving is:

$$1 - rR(\tau_1) - eE(\tau_2) = k - \frac{r\tau_1^2}{2} - \frac{e\tau_2^2}{2} \qquad (7)$$

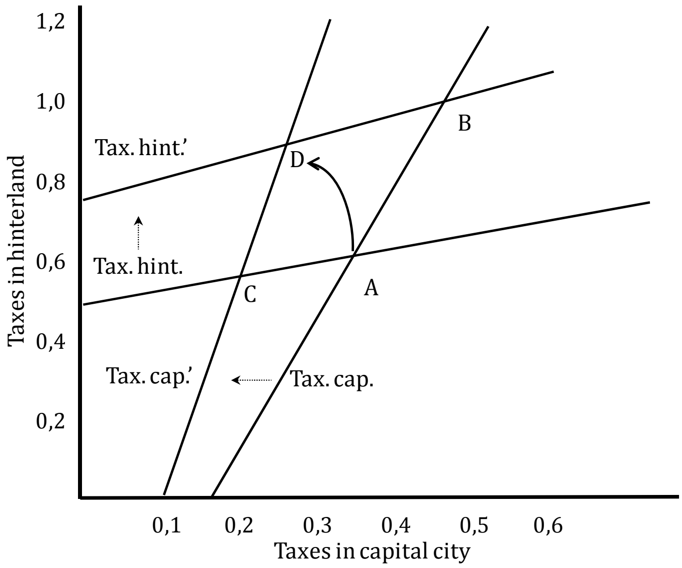
So, (4b) and (5b) become:

$$-rV\tau_1 + \frac{1}{4}(\tau_2 - \tau_1) + \frac{1}{4} + \frac{1}{4}(\tau_2 - \tau_1) = 0 \rightarrow \tau_2 = -\frac{1}{2} + (1 + 2rV)\tau_1 \qquad (4c)$$

$$-eV\tau_2 + 1 - \frac{1}{4} - \frac{1}{4}(\tau_2 - \tau_1) - \frac{1}{4}(\tau_2 - \tau_1) = 0 \rightarrow \tau_2 = \frac{3}{(2 + 4eV)} + \frac{2}{(2 + 4eV)}\tau_1 \qquad (5c)$$

which are respectively the line with positive and >1 slope in figure 2.7 and the line with positive and <1 slope in the same figure.

Figure 2.8. Illustration from Glaeser (1995) with modifications



Source: Ades and Glaeser (1995) with few modifications

The process begins in point A. The government requires to increase wages of citizens living close to the center of power (capital city), where riots are more prone to destabilize the regime; therefore the government decides to lower taxes in the capital city to improve its electoral support. Nevertheless, to finance this policy, the government "sacrifices" the hinterland, increasing taxes there, because in these locations revolts have less political effect than in the capital city and as a consequence, the interaction between taxes in the capital city and in the hinterland arrives to a point D, where the gap between τ_1 and τ_2 has increased. This fact impels rural-urban migration shaping a "giant city."

Finally, to test the model, the authors propose to estimate the size of main cities for the period 1970-1985, through the following relation:

$$\ln(N_c) = \alpha + \beta_1 \ln(N_u) + \beta_2 \ln(N_h) + \sum_{j=1}^{j=n} \delta_j x_j$$

Nc: log average population in main city

Nu: log of average urbanized population outside the main city

Nh: log of average non urbanized population

x: countries' characteristics, such share of trade in GDP, land area, share of labor outside agricultural sector, political variables.

Table 2.8 presents the empirical results for the regression, in the specification containing almost all the relevant variables.

Table 2.7. Ades and Glaeser, 1995. Table IV, (6)

Dependent variable: Log of average population in main city (1970-1985)	
Intercept	0,297
	(1.063)
Capital city dummy	0.408
	(0.188)
Log average non urban pop.	0.641
	(0.071)
Log average urban pop. Outside main city	0.045
	(0.038)
Log land area	0.120
	(0.055)
Log average GDP per cap	0.166
	(0.148)
Average share labor force outside agro	3.071
	(0.516)
Share of Trade on GDP	-0.519
	(0.244)
Dictatoship dummy	0.705
	(0.181)
Africa dummy	0.172
	(0.257)
Latin America dummy	0.295
	(0.162)
Revolutions and coups	2.372
	(0.772)
Number of observations	85
Adjusted R^2	0.84

Standard errors in square brackets
Source: Ades and Glaeser (1995:209)

The results show that among economic factors the share of labor outside agriculture has a significant effect on main city growth. On the other hand, as in Krugman and Livas (1992), the share of trade on GDP, acts to reduce primacy. Among political variables the revolutions and coups, as well as the presence of dictatorships, are important factors that increase main cities' sizes. Ades and Glaeser conclude that:

> "Our political results are stronger than our results of trade. They display robust causality running from dictatorship to urban centralization. Urban giants ultimately stem from concentration of power in the hands of a small cadre of agents living in the capital (...) Migrants come to the city because of the demand created by concentration of wealth, the desire to influence the leadership, the transfer given by the leadership to quell local unrest and the safety of the capital". (Ades and Glaeser, 1995:224)

Gaviria and Stein (2000) updated Ades and Glaeser (1995) using a panel approach, considering a period of 30 years (1960-1990) for a set of 105 countries. They made some changes, including the effect of ports, the share of agriculture on GDP, changes in openness (measured as the change in total exports and imports on GDP from one decade to the next), ethno linguistic fragmentation and GDP growth. Additionally, they consider the standard deviation of GDP growth as a measure of economic stability or instability.

Their findings indicate that trade liberalization does not necessarily reduces main cities' growth, contrasting in some extent with Krugman and Livas (1992). They find that the effect of ports located near the main city diminish the effect of trade to reduce primacy. In this sense, their empirical evidence confirms the model of Fujita and Mori (1996) which considers the "lock-in" effects of city ports on agglomerations due the strong pecuniary externalities that arise. Additionally, Gaviria and Stein indicate that main cities grow faster in agricultural-based economies, as well as among economies that experience a temporary "burst" of economic growth. Another relevant issue is that the rate of growth of main cities slows down according the size of the city, due to congestion costs.

They conclude that reducing political and economic instability reduce population growth in main cities; however they point out that it is difficult to indentify a systematic relationship between political regime and the *rate* of population growth in main cities.

2.5.3. The Contribution of Davis and Henderson

Davis and Henderson (2003) present an interesting study about the role of political dimensions on primacy for about 85 countries with data from 1960 to 1995. Their analysis, as Ades and Glaeser's, considers several political, economic, geographic and demographic variables. Additionally, following Weathon and Shishido (1981), they introduce a non-linear effect of national urban population and GDP per capita with the aim to analyze if economic growth and urban population perform a U-shape dynamic on primacy due to congestion costs.

The model considers the primacy rate as dependent variable. The estimation strategy is as follows:

$$P_{jt} = \alpha_0 \ln(Nup)_{jt} + \alpha_1 \left[\ln(Nup)_{jt}\right]^2 + \alpha_2 \ln(GDPpc)_{jt} + \alpha_3 \left[\ln(GDPpc)\, jt\right]^2 + \alpha_4 X_{jt} + \delta_t + \mu_j + \varepsilon_{jt}$$

Where:

P : indicates the primacy level

Nup : national urban population

$GDPpc$: GDP per capita

X : captures a set of policy variables including a democracy index; a federalism index and dummies for central planned economy and capital city. Also an openness measures (trade on GDP) and an index of transport infrastructure, are considered.

δ : variables indicating worldwide time shocks trends

μ : variables indicating country fixed characteristics: land area, waterways, ethno linguistic fragmentation, legal origin, religious affiliation.

The study show that more democratic and federalist countries are linked to less primacy rates. The variable of central planned economy shows a negative relation with primacy; according to the authors, this suggests an "anti-big" city policy that central planned economies follows to avoid political problems - i.e. internal migration policies were common among communist regimes, as Ades and Glaeser (1995) underlined-. Finally, the study shows the importance of waterways and transport infrastructure in reducing primacy.

Certainly, one of the most important contributions of Davis and Henderson is the introduction of non linear relationships of urban population and GDP per capita, as well as the consideration of more institutional variables in the assessment of urban concentration.

The results indicate that the relationships between primacy and national urban population or GDP per capita, are U-shaped. GDP per capita and urban population rise primacy until a certain level and then makes it decline. These observations are coherent with Wheaton and Shishido's (1981) observations.

2.6. Urbanization and Economic Development: Relevant Issues and Questions

The urban phenomenon is complex and cannot be assessed only by a unique theoretical framework. Bairoch (1988) pointed out that urbanization is certainly linked to economic development processes. In the same perspective, Arthur (1988) considered that the emergence of a particular urban pattern is not only the result of economic determinism but also due to history-dependent processes. Krugman (1993) remarked that the elements that shape the urban spaces are of first nature (historical accidents or geographic characteristics) and second nature (centripetal and centrifugal economic forces).

Von Thünen (1826) was the first in introducing how economics shape the intra-urban space in a "monocentric" world. On the other hand, Christaller (1933) and Lösch (1954) analyzed how these forces work in inter-urban space. Their theory of market areas was developed using strong basic assumptions, such as the presence of isotropic land (without roughness and weather change), even distribution of population and resources on the urban space, similar purchasing power and transport costs proportional to distance.

In this theory, the spatial distribution of cities or of productive and administrative functions, correspond to an optimal economic behavior where the location of industries and functions, would tend to be at central places to capture the benefits of economies of scale; meanwhile consumers will commute to closer areas where it's possible to achieve more goods and services at less transport costs. This implies that cities will become spatially diffuse and hierarchically organized, where each city has its own market area which is proportional to the level of goods and services that are supplied; in this location pattern, economic efficiency is achieved.

The same idea supports the concept of optimal city sizes. According to Alonso (1971) the urban space is constantly affected by costs and benefits linked to agglomeration. The optimal city size is achieved when incremental agglomeration benefits are offset by incremental agglomeration costs. The optimal city size theory does not imply necessarily the existence of standard cities sizes, because cities tend to be specialized in some economic activities which exert different agglomeration forces (Henderson, 1974). As a result, in equilibrium different optimal city sizes can be observed in an urban system.

Wheaton and Shishido (1981) observe that urban growth is linked to the level of economic development: urban concentration is positively connected to economic take-off (which in general imply a technology with higher increasing returns) and after a certain point this relation takes a negative sign, creating (for developed countries) a dispersed urban landscape. Efficient economic systems combine high rates of urbanization and a lower rate of urban concentration.

Optimal urban structures arise in a perfect competition framework which implies, *inter alia*, the existence of enough information to take an adequate location decision.

However, this does not always occur. There are both economic and non economic forces that push towards agglomeration. We have seen that we can add, to the economic drivers in the above approach, others that are non-economic. We have stressed the importance of geographic characteristics. In particular we have underlined the institutional and political factors, information problems and the bad functioning of markets (Stiglitz, 1985) that can lead to a very unbalanced city size distribution.

People usually migrate to the city due to the presence of higher wages than in hinterland. This consideration was also present in Lewis's (1954) approach to structural economic change, in the Harris and Todaro (1970) model of urban migration, in Krugman's (and other scholars) approach to possible large agglomerations when imperfect markets exists.

Furthermore, Ades and Glaeser (1995) demonstrated that weak democracies and protectionist trade polices tend to create giant cities. Finally Davis and Henderson (2003) present a model that explains primacy, involving several of the elements that have been already mentioned and considering nonlinearities of GDP per capita and urban population.

It is then easy to observe patterns of non-performing urbanization, where people migrates to larger cities expecting to improve their income; however due to the inadequate information of prices in goods and services that affect their welfare (increasing cost of housing, transport, education and health), the expected benefits not always are achieved.

As a consequence of this analysis, we can consider that the emergence of the urban systems can be non-optimal particularly among developing countries, which today present the most dynamic urban growth.

At this point, the two main issues identified in Chapter 1, remain valid. In this sense, we consider appropriate to deepen the analysis on the factors that are impelling growth in different categories of cities: large agglomerations (mega and big), midsize cities and small cities, as well as the feedback effect of the urban structure (concentrated or not) on economic development.

3. The Dimension of Cities, Urban Structures and Growth: Glaeser and Kim Revisited

3.1. Introduction

In the previous chapters important hints about the patterns of urban growth during the last decades and several theoretical contributions to understand the main urban dynamics that affect the growth of cities, have been proposed.

However, to answer the two questions we stated in Chapter 1, it is important a better understanding of the particularities behind the population growth among different cities sizes that compose the urban structure and the possible links of this on economic growth.

In this chapter, we intend to give some responses to these questions, using a methodological framework that is similar to those used in important empirical studies on city growth. In particular the models proposed by Ades and Glaeser (main cities sizes) and Davis and Henderson (primacy rates), will be useful to assess to the first question about the drivers of main cities growth.

In the last part of the chapter, we will review the second question, presenting the results of Kim (2007) about the existence of a feedback effect of the urban structure on economic growth. Using a longer period of time (1960-2000) and almost all the variables used in Kim's model, we give a first answer to this question.

The chapter is organized as follows: the first part presents an analysis of the determinants of growth in main cities, considering a period of forty years, to observe if there have been changes in the drivers of population growth in type of cities. Within this empirical framework, we will also introduce new variables that could improve the understanding of this issue; moreover, our analysis is done also distinguishing countries (and their main cities) according to the income level, to observe if there are differences between the factors that govern the dimension of main cities among developing and developed countries.

The second part is focused on the study of large agglomerations. The group of Mega and Big cities will be analyzed to understand if the factors that shape their growth differ from those indentified in the group of main cities. This will allow us to comprehend the dynamics behind large agglomerations and if the growth among Mega and Big cities is linked to a performing or non-performing urbanization processes. Finally, we analyze the factors behind the growth in Midsize (differentiating main or non main cities) and Small cities.

The last part of the chapter is focused on the possible feedback of the urban structure on economic growth. We present a model which links economic growth with the quality of the urban structure, measured by the different variables in particular Zipf's parameter and primacies rates.

A limit of this analysis is the lack of previous empirical studies (with the exception of Kim, 2007); thus, we cannot present a complete inquiry on this issue, we will only acknowledge if there are sufficient elements to suggest further studies on the field. We consider that this is a valid research goal, because the urban structure has been mainly considered as an endogenous element.

At the end, we summarize our main findings.

The chapter includes several regressions; therefore, to facilitate the observation we will only consider the sign of the different coefficients and their level of significance. Further details on the regressions can be found in Appendix 3.1.

3.2. Growth in Main Cities: Ades and Glaeser Revisited

As it has been mentioned in Chapter 2, the study of Ades and Glaeser (1995) considers a period of fifteen years (1970-1985) and analyzes the dimension of main cities in a sample of 50/85 countries (according to the different regressions). Their analysis does not consider the size or category of the city, but only the fact of being main city in a country. However, as it can be observed in Table 3.1, the distribution of main cities among different cities sizes has changed considerably in the last forty years. Hence, the idea that drivers of main cities dimension can differ among different cities sizes is, we think, well grounded.

Table 3.1. Cities sizes and main cities (1960; 2000)

City size	Main cities 1960	Main cities 1970	Main cities 1980	Main cities 1990	Main cities 2000
Mega and Big	9	12	15	23	26
Midsize	21	26	30	35	43
Small and Town	104	96	89	76	65
Total	134	134	134	134	134

Source: Urban dataset, our elaboration.

Consequently, it is reasonable to deepen the analysis on main cities, especially because we can consider a larger period of time than previous studies. However, it is important to acknowledge *three* main weaknesses of our analysis:

First: several estimation strategies that look for determinants of growth in cities located in different world's regions, use urban agglomeration numbers (see for instance Ades and Glaeser, 1995; Gaviria and Stein, 2000; Davis and Henderson, 2003; Henderson and Wang, 2007). This type of urban measurement presents inherent problems - already mentioned in Chapter 1 – because important aspects that define a city are neglected.

Additionally, several of these models explain the dimension of cities (main cities dimension or primacies) through national variables (i.e. economic structure, GDP per capita, trade openness); hence endogeneity problems arise. This is clear when large agglomerations and high primacy rate show a great overlapping between urban and national variables. However, a similar problem exist also in other urban structures with low primacy rates but high interlinks within the urban system; because the shapes of sparse urban systems can be linked to national indicators. In fact, national economic variables take also place within the cities that are under analysis; therefore high primacy rates, carry out critic problems of endogeneity.

Second: another potential problem is that of collinearities between explaining variables; for example economic development levels and institutional quality variables in the right side of the equation could show multicollinearity problems. We tried to control for these potential problems in our regressions, however conceptually the problem remains.

Third: another problem that remains is about relations of causation; for example the effect of the city size on trade openness or trade openness on city size. Ades and Glaeser (1995:213,216) test for it, although they remark that their method remains imperfect. Certainly, their (simply) cross-country estimation strategy presents limits to explain causality.

In the intent to avoid this problem, Gaviria and Stein (2000) follow the basic structure of Ades and Glaeser's model to explain main cities sizes but using a panel approach:

> "Our methodological choices allow us not only to study the dynamics of urban concentration (e.g., do main cities grow slowly as they become larger?), but also to examine more accurately the effects of political and economic factors on the rise and fall of main cities. (…). In this case one no longer focus on the determinants of the levels of urban concentration, but rather on the determinants of the changes in urban concentration. The main problem of this approach is that one would have to make arbitrary assumptions about the length of the time horizon needed to discern the effects of time-varying variables on urban concentration" (Gaviria and Stein, 2000:3,10).

This study offers a valuable contribution to understand causal relations particularly between trade and city growth, while other findings do not differ much from Ades and Glaeser's. To test causality the panel approach seems to be the more suitable. However, Gaviria and Stein results permit to say that the method of Ades and Glaeser remains valid.

The empirical analysis that we will follow is a combination of estimation strategies, using both average (or levels) and changes in the critical variables to grasp some basic indicators that have shaped growth in cities.

Our first group of regressions (see Table 3.2) presents a "basic" model for explaining main cities dimension in the urban agglomeration form[1]. The results give us some indications about the drivers that impel the size of main cities. Adjusted R squares are also similar to those obtained by Ades and Glaser. We describe bellow the main results, as they are shown in regressions (1) to (10) of Table 3.2.

Regression (1), which is the most similar to the regression proposed by Ades and Glaeser, shows that several factors -already identified by the mentioned authors- remain valid, in particular the influence of non urban population, trade level (openness) and the institutional variables. However, some differences also emerge, in particular the importance of economic development (captured by the GDP per Capita that was not significant in Ades and Glaeser's results).

A first element regards *economic factors*: rural-urban wage differentials are impelling the expansion of main cities. Therefore, the attraction exerted by main cities in emerging regions is strong, particularly if these are surrounded by large levels of non urban population. Large wage differentials between "pure urban areas" and "pure rural" ones, are impelling rural-urban migration towards the main city. The GDP per capita variable presents a positive and significant effect on the dimension of main cities; this is in the line with the negative and significant effect of the share of Agriculture in GDP, a variable that in many countries is linked to economic backwardness; hence rural-based structure reduces main cities dimension.

A second element is the effect of *economic policies*. Trade openness is negatively linked with the dimension of main cities. In this sense, Krugman and Livas hypothesis is again confirmed. Being open to international trade reduces the importance of the backward and forward linkages in the main city (circular causality). Trade policies are important in shaping urban agglomeration patterns.

A third element regards *institutional factors:* good political regimes (democracies) are clearly linked to lower dimension of main cities, consequently Ades and Glaeser hypothesis is confirmed. Countries with weak institutions (i.e. dictatorships) tend to have higher main cities sizes. Moreover, if we consider that countries ruled by autocratic governments reduce their openness, we have a relation between the low value of policy (trade openness) and political quality (autocracy) and higher main city size; thus a non-performing urbanization process will arise.

[1] The dimension of the main city is calculated by the log average of their agglomeration population in 1960, 1970, 1980, 1990 and 2000.

Table 3.2. Ades and Glaeser revisited

Dependent Variable: log average **Pop. Main Cities** 1960-2000	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Capital city dummy	ns	ns	ns	ns						
log average Non Urban Population	** (+)	** (+)	** (+)	***(+)	** (+)	** (+)	***(+)	***(+)	***(+)	**(+)
log average Urban Pop. Outside Main City	*** (+)	*** (+)	* (+)	***(+)	***(+)	***(+)	***(+)	***(+)	***(+)	***(+)
log of Land Area	ns	ns	ns	ns						
log average GDP per Capita	** (+)	*** (+)	** (+)	** (+)	***(+)	***(+)	***(+)	***(+)	*(+)	ns
average Share of Agriculture in GDP	** (-)	ns	ns	** (-)	* (-)	* (-)	* (-)	* (-)	** (-)	* (-)
average Share of Trade in GDP	** (-)	*** (-)	ns	** (-)	** (-)	** (-)	** (-)	** (-)	** (-)	ns
average Political Regime	*** (-)	** (-)	** (-)	*** (-)	** (-)	** (-)	*** (-)	*** (-)	*** (-)	** (-)
average Political Executive Recruitment	ns	ns	ns	ns						
average Share Informal Economy in GDP		ns		ns						
log average Foreing Market Potentional		ns								
average Density of Paved Roads			ns							
averate Density of Railways			ns							
Africa dummy	ns	ns	ns		* (+)	ns	* (+)	** (+)		
Latin America and Caribbean dummy	*** (+)	* (+)	** (+)		*** (+)	*** (+)	*** (+)	*** (+)		
Asia and Middle East dummy		** (+)	ns		** (+)	** (+)	** (+)	*** (+)		
Western Europe & Offshoots dummy						ns				
Nearcoast							ns			
Ruggedness								ns		
Desert								** (-)		
Spain colony dummy				** (+)					***(+)	
Great Britain colony dummy				ns					ns	
French colony dummy				ns					ns	
Common law dummy										** (-)
Civil law dummy										ns
Socialist law dummy										* (-)
Number of observations	117	112	87	112	117	117	117	117	117	117
Ajusted R square	0,743	0,752	0,695	0,748	0,757	0,756	0,758	0,763	0,756	0,763

*** significant at 99%; ** significant at 95%; * significant at 90%; ns: non significant

Source: Urban dataset, our elaboration.

Note: Most averages of variables are of their 1960, 1970, 1980, 1990, 2000 values.

Although our institutional results are coherent with Ades and Glaeser, it is important to mention that our institutional variables differ; we are not using a dictatorship dummy or coups and revolution variable, instead we consider a variable measuring the combination of both democratic or autocratic government of the country (composite political regime variable) and/or the way through which political executives arrived to power (executive recruitment variable).

Perhaps, our political variable is not able to capture some elements; as a matter of fact, it is feasible to observe a country with a high political regime indicator (democracy), although it can also present severe weaknesses in its institutional arrangements (i.e. high administrative centralism and weak local governments).

Another aspect to highlight is the significance of the regional variables, in particularly dummy variables that belong to Latin America and Asia-Middle East regions; which present specific regional characteristics (most likely of institutional type) that are affecting positively their main cities dimension.

In addition, we observe that legal systems (another institutional characteristic) matter; countries under a common law system present a negative and significant dummy variable, meanwhile countries under a socialist law system present a weak negative significance, we think because of internal migration policies that socialist countries have applied (see Simmons, 1979) to avoid social and political problems of rural-urban migration.

To deepen the analysis, we have considered other institutional dummies, taking into account the past colonial origin of the country. As results of the regression (4) shows, the Spanish colony dummy is the only positive and highly significant, which explains the high effect on main city dimension exerted by Spaniards' colonial institutions.

Ades and Glaeser (1995) already gave attention to the phenomenon of main cities sizes in Latin America. They consider as an example the case of Buenos Aires:

> "Buenos Aires retained a larger proportion of its immigrants (...) possibly because of: (1) undeveloped transportation facilities within the hinterland; (2) the absence of any other important pre-existing urban centers or industry in the hinterland; (3) a decline in the demand for labor in the hinterland as agriculture was consolidated into large firms that replace labor with capital; and (4) instability in the hinterland coming from wars and unfriendly relations with the native Americans" (Ades and Glaeser, 1995:222).

In this sense, we add to Glaeser's list the institutional arrangement that the colonial era has left in some countries, especially those under the Spaniard Empire; fact that would coincide with the analysis of Acemoglu and Robinson (2004), which considers that both dense level of human settlements and rich endowments of natural resources shaped, in a particular way, the type of institutions during the colonial era. For instance, main Spanish colonies were characterized by the presence of strong concentration of political power and trade control in a unique city: the viceroy city.

Other variables such as transport infrastructure, share of informal economy in GDP, Foreign Market Potential and geographic characteristics (except the presence of deserts), do not show any particular effect on main city dimension.

To conclude the analysis, we consider the parameters of the regressions already reviewed (see Appendix 3.1., Table 3.2). As general pattern we have noticed that, most observations of Ades and Glaeser (1995) are confirmed, although we consider a longer time period (40 years). These are mainly:

- The role of institutions (concentration of power) and trade openness; the former increases and the latter reduces the agglomerations forces towards the main city.
- The dimension of main cities is related to the size of non urban population and of urban population outside of the main city.
- The level of GDP per capita plays a crucial role in explaining the dimension of the main city, while this variable was not significant in Ades and Glaeser analysis.

These findings suggest that countries with large non urban population, lack of openness, concentration of power, and increasing GDP per capita (particularly in the capital city), will suffer increasing rural-urban wage differentials and insecurity in the hinterland; hence rural-urban migration to the main (capital) city will boost.

3.2.2. Determinants of Main Cities Dimension and Income Level

Although main cities share a similar role in the urban structure, usually being the center of power, their drivers of growth are not necessarily the same. To analyze possible differences, we have split our sample of main cities into three groups according the per capita income of the country: high, middle and low GDP per capita level. Table 3.3 summarizes the information of these three groups of countries.

Table 3.3. Main cities according their GDP per capita in US$ (2000)

Income level	Mean	Minimum	Maximum	Std. Deviation	Obs.
Low	1.533	217	3.420	908	62
Middle	6.232	3.439	11.710	2.068	41
High	19.522	12.110	28.467	3.942	27
					130

Source: Urban dataset, our elaboration

The distribution of countries between the three groups of high, middle and income level, has been obtained using the Rank command of SPSS software, so it could be debatable. For our purposes, anyway we think that the distribution of countries in the three groups (see in Appendix 3.2 the list) is opportune.

As we mentioned in Chapter 1, we consider that due to institutional, historical and economic factors, it is very difficult to do a consistent comparison between cities dimension in developed and developing countries. Land regulations, advanced transport and knowledge intensive industries in developed countries have shaped in different way urban sizes.

These facts require the consideration of the city size under a functional criterion, rather than a physical one. Under this perspective Cheshire and Magrini (2002; 2006) offer a valuable contribution where determinants of city growth are analyzed considering FUR sizes; additional they use explanatory variables that avoid potential problems of endogeneity and collinearity. Nevertheless, in this research we will not be able to consider this approach, because of the lack of suitable data in developing countries. Certainly, this decision implies that interpretations of our research's outcomes should be prudent.

For these reasons and due to the few observations that we have in this group, we will not apply our estimation strategy to high income countries; however we present a set of bivariate correlations (see Table 3.4) between our explanatory and the dependent variables (growth in the dimension of main cities or average of population).

Main cities dimension in high income countries: analyzing bivariate correlations

Table 3.4. Pearson correlations: Growth in Main cities of High Income Countries

Variables	Change Population Main City 60_00[1]	Average Population in Main City 60_00[2]	Numer of Observations
Log average Urban Pop. out main city 60_00	-,326	,531**	25
Log Land Area	-,176	,205	27
Log (pcGDP_00) - Log (pcGDP_60)	-,061	,412*	27
Average_Trade on GDO 60_00	,181	-,119	27
Log average Foreign Market Potential _60_00	-,385	,010	26
Average Polity_60_00	-,509*	-,190	24
Average Executive Recruitment_60_00	-,569**	-,186	24
Average Density railways 60_00	-,358	,111	22
Average Agriculture on GDP_60_00	,245	-,010	26
Tropic land	,112	-,047	27

**. Correlation is significant at the 0.01 level

Source:Urban dataset, our elaboration.

*. Correlation is significant at the 0.05 level

[1] Change corresponds to: Log (Pop. Main City_00)- Log (Pop. Main City_60)

[2] Much average of variables are of their 1960, 1970, 1980, 1990, 2000 values

When we consider the change in population in the main city, the variables that arise significant and negatively correlated are institutional ones. It means that good institutional settings have contributed to reduce growth in main cities, probably due to better enforcement on land regulation, better quality and capillarity of public services through the hinterland, among other elements.

Additionally, if we consider the level of the dimension of main cities, the variables that are significant and positively correlated are change in income level and the dimension of the urban population outside the main city. These relations can be indication that the growth in developed main cities regards better income levels (probably higher real wages in main cities) that are attracting urban settlers which represents the larger populations in developed countries (high urbanization rates). This observation, could be related with recent literature on *urban resurgence* (see for instance Glaeser and Gottlieb (2006), regarding raising real incomes in US cities).

These two main elements: significant-positive correlation with income changes and significant-negative correlation with good institutional variables, show us that the urbanization process among high income countries is performing type.

Main cities dimension in middle income countries

To continue our analysis, in Table 3.5 we present the results for the middle income group. The first issue to highlight is that, using the same estimation model, the adjusted R square goes up to 0.70/0.80[2]. We notice that the most relevant variables in explaining main cities dimension are similar to the "basic" or general findings of Table 3.2; the key drivers behind main cities growth or decline are the urban population out of the main city, GDP per capita, openness and characteristics of the political regime.

Some particular factors that explain main cities dimension among this group of countries are geographical and institutional variables. In the former, stands out the land area (distance or transport costs), and in the latter the kind of colonial regime (Spain) and the related civil law system.

[2] It was only 0.3 for the high income country group.

Table 3.5. Drivers behind the dimension of main cities to countries with middle income

Dependent Variable: log average **Pop. Main Cities** that belong to the **Middle Income group** 1960-2000	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Capital city dummy	ns	ns	ns	ns	ns	ns	ns	ns
log average Non Urban Population	ns	ns	ns	ns	ns	ns	ns	*** (+)
log average Urban Pop. Outside Main City	** (+)	** (+)	** (+)	** (+)	** (+)	** (+)	*** (+)	** (+)
log of Land Area	ns	* (-)	*** (-)	* (-)	ns	ns	* (-)	** (-)
log average GDP per Capita	ns	** (+)	* (+)	** (+)	** (+)	*** (+)	** (+)	*** (+)
average Share of Agriculture in GDP	ns	ns	ns	ns	ns	ns	ns	ns
average Share of Trade in GDP	*** (-)	*** (-)	*** (-)	*** (-)	ns	*** (-)	* (-)	ns
average Political Regime	ns	ns	ns	** (-)	*** (-)	*** (-)	* (-)	* (-)
average Political Executive Recruitment	ns	ns	ns	ns	ns	** (+)	ns	* (+)
log average Foreing Market Potentional		** (-)	** (-)	* (-)	ns	ns	* (-)	ns
Informeco_GDP				ns	ns	ns	ns	ns
averate Density of Railways			ns					
Latin America and Caribbean dummy					** (+)			
Africa dummy					ns			
Asia and Middle East dummy					ns			
Nearcoast						ns		
Ruggedness						* (+)		
Desert						ns		
Spain colony dummy							** (+)	
Great Britain colony dummy							ns	
French colony dummy							ns	
Civil law dummy								*** (+)
Common law dummy								ns
Number of observations	40	40	30	39	39	39	39	39
Ajusted R square	,788	,809	,703	,825	,857	,844	,848	,893

*** significant at 99%; ** significant at 95%; * significant at 90%; ns: non significant

Source: Urban dataset, our elaboration.

Note: Most averages of variables are of their 1960, 1970, 1980, 1990, 2000 values.

Main cities dimension in low income countries

For this group of countries the main surprising results are the following (see Table 3.6).

Firstly, economic variables have a low significance. The level of development (GDP per capita) has no effect, neither have effect other variables measuring economic structure (like the trade variable); the only significant economic structure variable is the share of agriculture on GDP, with a negative coefficient: countries with a relevant share of primary sector, hence more rural, have lower dimension of their main city. This is the only relation between economic variables and main cities dimension.

Secondly, the most astonishing result is that for these countries institutional and political variables have no significance. Neither has significance an indirect institutional variable as the level of informality of the country. We think that these results derive from strong limitation in our institutional and particularly political variables. As we have already said, our institutional variables do not consider political shocks, political turmoil periods or civil conflicts which in reality have affected many low level countries in the period analyzed. All these elements can be "flattened" by our variables of political regime and executive recruitment.

We believe that many of the drivers in main cities dimension in these countries are of institutional type, however we have not been able to capture them. To control for this potential problems, we introduce -instead our classic political regime variable- the autocracy variables from our dataset for a specific year (see regression (8) in Table 3.6), which results positive and significant.

Finally, we can conclude that this group is certainly following a non-performing urbanization process, because two key variables are not affecting main cities growth: GDP per capita and non urban population. Therefore a higher dimension of main cities is delinked from two basic variables explaining a country's development or backwardness.

Table 3.6. Drivers behind the dimension of main in countries with low income

Dependent Variable: log average **Pop. Main Cities** that belong to the **Low Income group** 1960-2000	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Capital city dummy	ns	ns	ns	ns	ns	ns	ns	ns
log average Non Urban Population	ns	ns	ns	ns	ns	ns	ns	ns
log average Urban Pop. Outside Main City	** (+)	*** (+)	*** (+)	***(+)	ns	**(+)	***(+)	*(+)
log of Land Area	ns	ns	ns	ns	ns	ns	ns	ns
log average GDP per Capita	ns	ns	ns	ns	ns	ns	ns	ns
average Share of Agriculture in GDP	*** (-)	*** (-)	*** (-)	** (-)	** (-)	** (-)	** (-)	** (-)
average Share of Trade in GDP	ns	ns	ns	ns	ns	ns	ns	ns
average Political Regime	ns	ns	ns	ns	* (-)	ns	ns	***(+)[1]
average Political Executive Recruitment	ns	ns	ns	ns	ns	ns	ns	
log average Foreing Market Potentional		* (-)	* (-)	ns	ns	* (-)	* (-)	
average Share Informal Economy in GDP			ns	ns	ns	ns	ns	
Latin America and Caribbean dummy				ns				
Africa dummy				ns				
Asia and Middle East dummy				ns				
Nearcoast					*(+)			
Ruggedness					* (-)			
Desert					ns			
Spain colony dummy						ns		
Great Britain colony dummy						ns		
French colony dummy						ns		
Civil law dummy							ns	
Common law dummy							ns	
Socialist law dummy							ns	
Number of observations	54	54	50	50	50	50	50	45
Ajusted R square	,746	,759	,768	,768	,799	,766	,778	,792

*** significant at 99%; ** significant at 95%; * significant at 90%; ns: non significant

Source: Urban dataset, our elaboration.

[1] In regression (8) instead of the political regime variable, we use the autocracy variable (year 1970)

3.3. Mega and Big Cities: Performing or Non-performing Urbanism?

Now, we consider a central issue in our work, the study of the largest agglomerations, which constitute a particular type of main cities. As we have already mentioned, this category of cities (Mega) are attracting the attention of scholars and policymakers, although few studies have been carried out only to this type of cities. One limit, certainly, is the number of observations, reason why we test together Big and Mega cities.

First we have regressed their population growth *à la Glaeser* (see Table 3.7a); however the results are disappointing. Considering these results, we changed the model specification; hence we tried to use a model *à la* Henderson, introducing non-linearities for non urban population and GDP per Capita, but maintaining as dependent variable a log of average population of the main city (dimension) and not the primacy rate as in Henderson's model; also in this case we obtain elusive results, reported in Table 3.7b.

Table 3.7. Drivers behind the dimension of Mega and Big cities

a. Dependent Variable: log average **Pop. Mega & Big Cities**	(1)
log average Non Urban Population	ns
log average Urban Pop. Outside Main City	ns
log average GDP per Capita	ns
average Share of Agriculture in GDP	ns
average Share of Trade in GDP	ns
average Political Regime	ns
Number of observations	39
Ajusted R square	,299

b. Dependent Variable: log average **Pop. Mega & Big Cities**	(2)
log Non Urban Pop. 1960	*(+)
Square log Non Urban Pop. 1960	* (-)
log of Land Area	ns
log GDP per Capita 1960	ns
Square log GDP per Capita 1960	ns
average Political Regime	ns
average Share of Trade in GDP	ns
average Share Informal Economy in	ns
log average Foreing Market	ns
Number of observations	40
Ajusted R square	,217

*** significant at 99%; ** sig. at 95%; * sig. at 90%; ns: non significant

Source: Urban dataset, our elaboration.

Therefore, we introduced a different dependent variable: the change in population between 1960 and 2000[3]. The results improve considerably; this is because the use of averages as dependent variables flattens the real change in this particular type of agglomeration, which has experimented, during the last forty years, an unprecedented growth. Table 3.8 presents our results.

The first element to acknowledge is that demographic variables, as the dimension of urban population outside of main city and the dimension of non urban population, are not between the significant explaining variables.

A second element is that economic maturity (level of GDP per capita at the beginning of the period) is unrelated with population change in Mega and Big cities; and economic growth is even negatively correlated with the same change.

[3] Change in population corresponds to the logarithm of the population in Mega and Big cities in 2000 minus the logarithm of the population in Mega and Big cities in 1960.

The only more general economic variables that have a significant value are the foreign market potential variable and - more weakly - the trade variable (which, as always, lowers the size of the city, in this case the mega and big ones).

A third element regards a geographic variable, the size of land of the country, which works as a natural barrier to the dimension of mega and big cities because of higher transport and migration costs.

Fourthly, political variables have no significance. Only a variable that indirectly can be interpreted as a measure of bad institutions, i.e. the level of informality in the economy is significantly and positively related to change in the dimension of these cities.

In synthesis, we think that it is possible to affirm that almost all these results indicate that we are in presence of non-performing processes of urbanization, because the growth of Mega and Big cities is driven neither by positive economic variables (like level of development or economic growth) nor by the classic demographic variables like the dimension of urban and non urban population. It is instead driven by weak institutions and dysfunctioning markets (informality).

Growth in Mega and Big cities corresponds to Hoselitz's (1957) hyper-urbanization, where migration rates grow faster that urban employment. Hence, new settlers are forced to move into the informal economic sector with deplorable living conditions and congestion. This phenomenon is also coherent with Harris and Todaro (1970) analysis on the effect of both rural-urban wage differentials and expected wage differential which impel migration flows to the large agglomeration, greater that the demand of (formal) labor positions.

Table 3.8. Change in Population in Mega and Big cities (1960-2000)

Dependent Variable: **Change Population 1960-2000 in Mega and Big cities** (log PopCity00- log PopCity60)	(1)	(2)	(3)	(4)	(5)	(6)	(7)
log Non Urban Pop. 1960	ns	ns					
Square log Non Urban Pop. 1960	ns	ns					
Share Non Urban Pop. 1960			ns		ns	ns	ns
Square Share Non Urban Pop. 1960			ns		ns	ns	ns
log of Land Area	*** (-)	*** (-)	*** (-)	*** (-)	*** (-)	*** (-)	* (-)
log GDP per Capita 1960	ns						
Square log GDP per Capita 1960	ns						
Change GDP cap 1960 - 2000		*** (-)	*** (-)	ns	** (-)	*** (-)	** (-)
average Political Regime	ns	ns	ns	ns	ns	ns	ns
average Share of Trade in GDP	** (-)	ns	ns	** (-)	ns	ns	ns
average Share Informal Economy in GDP	** (+)	*** (+)	*** (+)	*** (+)	ns	***(+)	***(+)
log average Foreing Market Potentional	** (-)	*** (-)	* (-)	* (-)	** (-)	ns	ns
Latin America and Caribbean dummy					ns		
Africa dummy					ns		
Asia and Middle East dummy					ns		
Nearcoast		ns					
Desert		ns					
Rugged		ns					
Lowincome_00				*** (+)			
Highincome_00				ns			
Spain colony dummy						ns	
Great Britain colony dummy						ns	
French colony dummy						ns	
Common law dummy							ns
Civil law dummy							ns
Socialist law dummy							ns
Number of observations	40	40	40	40	40	40	40
Ajusted R square	,626	,693	,785	,697	,785	,783	,767

*** significant at 99%; ** significant at 95%; * significant at 90%; ns: non significant

Source: Urban dataset, our elaboration.

Note: Most averages of variables are of their 1960, 1970, 1980, 1990, 2000 values.

3.4. Growth in Midsize Cities: A complex Issue

In the first chapter, we indentified three main characteristics of Midsize cities: (1) strong stability in their Zipf's parameter; (2) great dynamic growth, representing, after Mega cities, the category with the higher rate of growth; (3) the hypothesis about the importance that midsize agglomerations could have in avoiding "polarized urban structures" that boost hyper-agglomeration and congestion.

Now we will analyze drivers of growth in the category of Midsize cities, being aware of the fact that, we find both main and non main cities, so there are differences and function dishomogeneities in this group.

To understand growth in cities, it is important to understand their role within the urban structure; for example, main cities are usually capital cities, so their growth is robustly shaped by political factors. On the other hand, in the group of Midsize cities only 20% are main cities; 80% are non-main.

Table 3.9 presents three regressions; regression (1) treats all the Midsize cities (both main and non-main).

Table 3.9. Drivers behind the dimension and change in Midsize cities population (1960-2000) considering different "types" of midsize cities

Dependent Variable: log average **Pop. Midsize Cities** 1960-2000	All Midsize (main & non-main) (1)	Midsize (main) (2)	Midsize (non-main) (3)
log average Non Urban Population	ns	ns	ns
log average Urban Pop. Outside Main City	ns	** (+)	* (+)
log of Land Area	** (-)	* (-)	** (-)
log average GDP per Capita	** (+)	* (+)	ns
average Share of Agriculture in GDP	ns	ns	ns
average Share of Trade in GDP	ns	ns	ns
average Political Regime	ns	ns	ns
average Political Executive Recruitment	** (+)	ns	ns
Number of observations	175	34	141
Ajusted R square	,273	,658	,233

*** significant at 99%; ** significant at 95%; * significant at 90%; ns: non significant
Note 1: Most averages of variables are of their 1960, 1970, 1980, 1990, 2000 values.
Source: Urban dataset, our elaboration.

As we can observe, in spite of the large number of observations, the adjusted R square is very low.

Then, we regress (regression (2)) the model with only "main" Midsize cities; the number of observations is much lower, but the adjusted R square is much higher; this can be explained by the type of model applied (Ades and Glaeser), which fits better to explain the drivers of main cities dimension. Finally, in regression (3) we apply the model only to "non-main" Midsize cities, where again the R square become again low: in fact this group is very similar to the first one (all midsize cities).

Comparing the three regressions, it can be seen that there are differences between main midsize cities and non main midsize cities; we refer in particular to the fact that for non main midsize cities, the variable related to the level of development (GDP per capita) is no longer significant. The absence of administrative and government functions result in the delinking between the dimension of midsize urban centers and economic growth.

This is why we have tried to deepen the analysis for non main midsize cities (see table 3.11) changing the dependent variable: we analyze the drivers of the change in the dimension of these group of cities in the period considered. The results of the four regressions reported in table 3.11 confirm the results of table 3.10. In particular, as it can be seen, the variable indicating the level of economic development is significant only in two cases (equations (6) and (7)), but with a negative sign of the coefficient; the variable describing the economic growth in the period is also non significant.

This confirms that growth in this group of cities is not linked to elements of economic change or maturity (also other symptoms go in this direction, as for instance the positive sign -when significant - of the variable measuring the share of agriculture on GDP).

Table 3.10. Change in Population of "non-main" Midsize cities (1960-2000)

Dependent Variable: **Change Population 1960-2000** in **"non-main" Midsize cities** (log PopCity00- log PopCity60)	(4)	(5)	(6)	(7)
log Non Urban Population 1960	*** (-)	*** (-)	*** (-)	** (-)
log Land Area	ns	ns	**(+)	ns
log GDP per Capita 1960			*** (-)	** (-)
log average GDP per Cap. 1960-2000		*** (-)		
Change GDP per Cap. 1960-2000	ns			
average Share of Agriculture in GDP	*** (+)	ns	ns	ns
average Political Regime		ns	ns	*** (+)
average Political Executive Recruitment			ns	ns
average Share of Trade in GDP	** (-)	*** (-)	* (-)	ns
average Density of Railways				*** (-)
Number of observations	139	140	139	131
Ajusted R square	,333	,376	,378	,447

*** significant at 99%; ** significant at 95%; * significant at 90%; ns: non significant

Source: Urban dataset, our elaboration.

Note: Most averages of variables are of their 1960, 1970, 1980, 1990, 2000 values.

As it can be seen, the phenomenon of Midsize cities is complex. The drivers that affect the size of both “main” and “non-main” Midsize cities are different. The former presents similarities with drivers that shape the dimension of main cities growth, while the latter presents indicator of economic backwardness, which suggest that their urbanization process is non-performing.

Finally, the question remains open about why this category of cities presents the most stable Zipf’s parameter, as we observed in the first chapter. One possible explanation is the effect of internal migration policies; about 35% of the observed Midsizes are located in countries under a socialist regime; hence, much of them have been using internal migration policies. If we regress the model including the Socialist law dummy, its coefficient is negative and highly significant. This confirms the hypothesis (for details see in Appendix 3.1. Table 3.17). However, for giving a conclusive answer, further analysis are required.

3.5. Growth in Small Cities: Performing Urbanism?

To complete our understanding of the urban system and the drivers that define the growth of the different groups of cities, now we analyze our last group: Small cities (0.5 to 1.5 mill inhabitants) that are “non-main” cities. Table 3.11 shows our main findings.

We use as dependent variable the change in population cities in this group for the period analyzed.

Small cities are impelled by trade (openness), good political regimes, change in GDP per capital; while are negatively affected by the size of land, the presence of near coasts and railways. Additionally, these factors are strong among developing regions.

The most interesting fact is that Small cities represent the first type of cities where the GDP per capita emerge positively. Growth in these cities is connected to both economic progress and trade openness.

As is indicated by the trade variable, trade openness supports their change in population, fact that is consistent with Krugman and Livas’ hypothesis. Therefore, international linkages reinforce urban deconcentration; consequently location decisions can take advantage of the benefits of Small cities, avoiding congestion and gaining from the quality of the services of these types of cities.

Small cities are highly affected by good regimes. This factor provides conditions of stability, security and perhaps contributes to reinforce administrative functions of the city.

Table 3.11. Change in Population of Small cities "non-main" (1960-2000)

Dependent Variable: **Change Population 1960-2000 Small cities** (log PopCity00- log PopCity60)	(1)	(2)	(3)
log Non Urban Population 1960	ns	ns	ns
average Share of Trade in GDP	* (+)	*** (+)	* (+)
average Share of Agriculture in GDP	ns	ns	ns
log of Land Area	*** (-)	ns	** (-)
Density of Railways 1960	*** (-)	*** (-)	*** (-)
Political Regime 1960	*** (+)	*** (+)	*** (+)
Change GDP per Capita 1960-2000	** (+)	*** (+)	ns
Nearcoast	*** (-)	*** (-)	*** (-)
Latin America and Caribbean dummy		*** (+)	
Africa dummy		** (+)	
Asia and Middle East dummy		*** (+)	
Spain colony dummy			ns
Great Britain colony dummy			ns
French colony dummy			ns
Number of observations	290	290	290
Ajusted R square	,364	,407	,361

*** significant at 99%; ** significant at 95%; * significant at 90%; ns: non significant
Note: Most averages of variables are of their 1960, 1970, 1980, 1990, 2000values.
Source: Urban dataset, our elaboration

In synthesis, three elements: good institutions, openness, and economic progress reinforce the growth process of this group of cities. Consequently, we think that Small city sizes are linked to *performing urbanization* process; where economic progress walk together with urban population changes, providing adequate conditions for economic growth.

Finally, geographic factors that curb the growth of this group of cities are: land area, near coast and railways. The way in which geographic factors shape their population changes, clearly differ from Main and Mega-Big cities.

Large agglomerations are positively affected by near coast; this is probably explained by the presence of main ports in main cities that are the "first nature" factor generating "agglomerative lock-in" as Fujita and Mori (1995) remark.

In the case of small cities, instead, the fact to be near coast can be detached from a first nature factor (being a "good" natural seaport). So the market and influence area can remain totally local (and perhaps, the hinterland served can be smaller, all other things equal).

As regards land area and railway's density, both their coefficients are negative. The explicative hypothesis we can do, is that in very large countries population urbanizes in cities of smaller dimension, due to distance; and good transport infrastructure (railways) reduce substantially migration costs towards larger cities. Both phenomena appear to be against the growth of cities of this dimension.

Another issue to underline is the presence of specific regional effects. Dummies of developing regions are highly significant, which suggest that growth in Small cities not always are of the performing type. As we saw in the first chapter, there has been a lot of "town" that have grown and entered in the category of "small" cities (with rates of growth that can be seen as "traumatic jumps") and, as a consequence, an increasing hierarchization of the group. Consequently, it is feasible to think that the basic good performance of Small cities could be severely affected by weak institutional drivers.

These results suggest that perhaps the international classification of cities according to the size should be revisited. We think that the concept of "intermediate cities", which balance the bigger centers in a more equilibrated urban system, fits more with the "small city" group (that is centers with a dimension of no more than 1.5 million people) and is not so appropriate for the "midsize" group (with a dimension from 1.5 to 5 million people). As we saw, the midsize group has dimension and growth drivers much more similar to these of the big and mega cities and, in any case, shows signs of non-performing urbanism.

Synthesizing

In Table 3.13 we summarize the main features of the drivers that shape cities of different sizes.

It is not simple to see a general pattern, however we can suggests some basic indications. Firstly, it seems that a factor that is pushing up city sizes is the institutional one, both concentrating towards megacities (when weak and insecure) and encouraging a network of cities of smaller dimensions (when good). Secondly, the equilibrating factors seem to be economic and geographical ones. Economic factors are important in growth of cities, but here also only for centers of a lower size (midsize cities, but much more, small cities), while not to explain growth in big and mega cities.

Another element that arises, regards the inter-city dynamics; that is to say how the different city sizes are intertwined in the same urban system. This aspect was not one of our main research purposes; however it is provoking and demands future analysis.

Table 3.12. Features of drivers that affect dimension or population change in different cities sizes (1960-2000)

Drivers of city dimension or change in population (1960 - 2000)		Main	Main middle income	Main low income	Mega and Big > 5 mill.	Midsize (non-main) 1.5 to 5 mill.	Small (non-main) 0.5 to 1.5 mill.
Demographic	Non Urban. Pop.	+++	+++			–––	
	Urban. Pop. out Main city	+++	++	+++			
Economic	GDP per capita	++	++		–––	––	++
	Sh. Agro in GDP	–		–––		++	
	Sh. Trade in GDP	––	–––		––	––	++
	Sh. Informality in GDP				+++		
Geographic	Land area		––		–––	++	––
	Near coast			+			–––
	Desert	–					
	Ruggedness		+	–			
	Railways					–––	–––
Institutional	Bad political regime		++	+++			
	Good political regime					++	+++
	Spanish colony	+++	++				
	Civil law		+++				
	Common law	––					
	Socialist law	–				–––	
Observations		87/117	39/40	45/54	40	131/140	290
Adjusted R square		High	High	High	High	Middle	Middle

Notes:

- High R square is considerd over 0.70; middle over 0.4
- Cells in blank, indicate absence of significance.
- Signs (positive or negative) represent the general pattern of the significance level.

Source: Based on our regressions results.

3.6. Concentrated or dispersed urban structures: Which one fits better for economic growth?

In the first chapter, we have highlighted the existence of a debate about which urban structure (concentrated or disperse) better contributes to economic development, especially in developing countries, which are transforming rapidly their urban landscapes.

It is important to mention that *concentrated urban patterns* imply the presence of Mega cities or supercities. On the other hand, *dispersed urban patterns* refer to the idea of polycentric urban structures (ESPON, 2004). A disperse urban patterns does not mean an extremely sparse settings; the latter does not shape any urban structure.

Currently it's recognized that the urban structure has an important role for economic growth. Moreover, as we analyzed in the second chapter, it is reasonable to think, that the urban structure can be considered a part of the "deep determinants" of economic growth, particularly in a increasing urbanized word; however empirical evidences are missing.

Kim (2007) represents one of the few efforts in examine these links; his analysis test the relation between the structure of the urban system and economic growth in a cross-country approach for 39 countries for the years 1991 to 1995; however he does not find any evidence of this connection (see in Appendix 3.2. its basics results). A limit of Kim's study is the short period of time, because the urban structure is a long term determinant of economic processes; hence, larger periods of time are required to observe the presence or not of feedback effects of the urban structure on economic growth.

Using our dataset we try to assess this possible link, applying the following estimation model:

$$Y_t = \alpha_0 + \beta_1 Y_{t-1} + \gamma_0 up + \sum_j \gamma_{1j} E_j + \gamma_2 z + \gamma_3 p + \gamma_4 I + \sum \gamma_{5h} G_h + \varepsilon$$

Y: GDP per capita.
Y_{t-1}: initial GDP per capita
up: share of the urban population
E: economic variables (Trade in GDP, Agriculture in GDP, etc.)
z: Zipf's parameter in its weighted version
p: primacy rate
I: institutional variable (political regime)
G: geographic variables (land size, etc.)

We capture disperse or concentrate urban patterns using: (1) the Zipf's parameter in its weighted[4] version; (2) the primacy rate as defined by Jefferson (1939), that is the ratio between the population of the largest city and that of the second and third largest cities, and (3) the initial level of urban population.

Using simple indicators which belong to the "deep determinants of growth" (trade, geography, institutions) and adding variables of urban structure, we assess if there are some results about how the urban structure matters in economic growth, measured by the GDP per capita.

Due to the characteristics of the model, it is difficult to achieve conclusive indications about the effects of the urban structure on growth and which type of structure enhances economic growth. However, our intention is not to offer exhaustive analysis on the issues; we simply look for basic indications that can orient further analysis on this field.

Our first results are presented in Table 3.13. (see details of the regression in Appendix 3.1).

The first element to highlight is the evidence that the urban structure affects the level of GDP per Capita. This is confirmed by the size and good significance of the Zipf's parameters in the regressions: This go in the direction of confirm a positive relation between *performing urban structures* and growth.[5]

As expected, the regional (Western Europe and Offshoots) and high income countries dummies are positive and highly significant: the combination of both relative high urbanization and income levels and disperse urban structure provide an adequate urban setting that allows the development of economies of scales, avoiding strong negative pecuniary externalities that arise in the presence of high hierarchical urban structures.

Most efficient urban structures combine both high urbanization rates and low hierarchical distribution of cities. This idea can also be traced in the "ideal" urban setting of Christaller (1933), where optimal structures arise in urbanized systems that present an organized hierarchy of cities, without the dominant presence of "black hole cities".

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[4] For details see the definitions of variables is Appendix 1.1.

[5] While the primacy variable, which is a symptom of the presence of too hierarchic urban systems, has no significance.

Table. 3.13. Urban structure and deep determinants' effect on GDP per Capita (1960-2000)

Dependent Variable: log GDP per Capita 2000	(1)	(2)	(3)	(4)	(5)	(6)
log GDP per Capital 1960	*** (+)	*** (+)	*** (+)	*** (+)	*** (+)	* (+)
Share Urban Population 1960	*** (+)	*** (+)	*** (+)	** (+)	ns	ns
Zipf's parameter	** (+)	** (+)	** (+)	ns	* (+)	** (+)
average Agriculture in GDP					*** (-)	*** (-)
average Trade in GDP					ns	ns
average Political Regime					** (+)	ns
log of Land Area					ns	ns
average Primacy 2 (1/2+3)		ns				
Latin America and Caribbean dummy			ns			
Western Europe & Offshoots dummy			** (+)	*** (+)		
Africa dummy				*** (-)		
High income country dummy						*** (+)
Low income country dummy						*** (-)
Number of observations	86	77	86	86	78	78
Ajusted R square	,764	,775	,781	,827	,812	,897

*** significant at 99%; ** significant at 95%; * significant at 90%; ns: non significant

Note: Most averages of variables are of their 1960, 1970, 1980, 1990, 2000 values.

Source: Urban dataset, our elaboration.

To deepen our analysis we split again our dataset by the income level of countries, to observe if the effect of urban structure differs among developed and developing countries. In a first test (high income countries), we only regress three variables, which where relevant in our previous regressions (see Table 3.14).

The results do not show any particular effect of the urban variables on GDP per capita. It seems that among developed countries the urban factors (urbanization level and urban structure) have exhausted their performing effect on economic growth; thus mature economies are in fact associated to performing urbanization structures, but further growth is linked to other factors.

Table 3.14. Urban structure and growth in high income countries

Dependent Variable: log GDP per Capita 2000	(1)
Share Urban Population 1960	ns
log GDP per Capital 1960	ns
Zipf's parameter	ns
Number of observations	22
Ajusted R square	,101

*** significant at 99%; ** significant at 95%; * significant at 90%; ns: non significant
Source: Urban dataset, our elaboration.

Then we test the effect of urban factor on GDP per Capital in middle and low income countries (see Table 3.15). The results show the presence of an effect of the urban structure on GDP per Capita. This would be an indication that in developing countries, the quality of the urban system is an element that should not be neglected. A performing urban structure matters in development.

Finally, it is important to mention that we have also tested the effect of the Zipf's parameter on the *change* of GDP per capita between 1960 and 2000 using a similar estimation strategy. Also in this specification of the relation between urban structure and growth, the Zipf's parameter is always significant (see Table 3.16).

Table 3.15. Urban structure and growth in cities that belong to middle and low countries

Dependent Variable: log **GDP per Capita 2000** that belong to the **Low and Middle Income** group	(1)	(2)	(3)	(4)	(5)	(6)
Share Urban Population 1960	***(+)	***(+)	**(+)	**(+)	***(+)	***(+)
log GDP per Capital 1960	***(+)	***(+)	***(+)	***(+)	**(+)	***(+)
Zipf's parameter	***(+)	***(+)	*(+)	*(+)	**(+)	*(+)
average Primacy 2 (1/2+3)		ns				
average Share of Trade in GDP					ns	ns
average Political Regime					**(+)	**(+)
average Share of Agriculture in GDP					ns	ns
Latin America and Caribbean dummy			ns	ns		ns
Western Europe & Offshoots dummy						ns
Africa dummy			*(-)			
Asia and Middle East dummy			ns	***(+)		
Eastern Europe dummy				*(+)		
Number of observations	63	55	63	63	83	83
Ajusted R square	,646	,675	,698	,698	,802	,809

*** significant at 99%; ** significant at 95%; * significant at 90%; ns: non significant

Note: Most averages of variables are of their 1960, 1970, 1980, 1990, 2000 valuess.

Source: Urban dataset, our elaboration.

Table 3.16. Urban structure and growth considering different countries income level
(dependent variable: *change* in GDP per capita)

Dependent Variable: **Change GDP per Capita 1960-2000** ln(GDPcap. 00)-ln(GDPcap.60)	All Income levels (1)	All Income levels (2)	Low & Middle Income (3)
log GDP per Capital 1960	*** (-)	*** (-)	*** (-)
Share Urban Population 1960	ns	ns	*** (+)
Zipf's parameter	** (+)	* (+)	*** (+)
average Primacy 2 (1/2+3)	ns		ns
average Agriculture in GDP	*** (-)	*** (-)	ns
average Trade in GDP	ns	ns	ns
average Political Regime	ns	** (+)	ns
log of Land Area	ns	ns	ns
Number of observations	70	78	49
Ajusted R square	,262	,247	,337

*** significant at 99%; ** significant at 95%; * significant at 90%; ns: non significant
Note: Most averages of variables are of their 1960, 1970, 1980, 1990, 2000 values.
Source: Urban dataset, our elaboration.

3.7. Conclusions

Although our analysis and estimation strategies are coherent with a specific theoretical and empirical framework, we acknowledge that our research's outcomes cannot be conclusive due the limits of the methods and variables considered. These are: (1) the physical definition of cities rather than a functional one, (2) the use of national variables to explain the urban agglomerations numbers, (3) the oversimplification of historical, institutional and social elements that are fundamental to understand different urban shapes, (4) the potential problems of collinearities (at least conceptually) between institutional elements and other economic and urban variables.

Taking these elements into consideration, our main findings on the analysis of changes in dimension of cities and on the feedback effects of urban structures (considered as a "deep" determinant) on growth, are:

1. The most important drivers behind the dimension of <u>main cities</u> are the following: (1) economic growth and maturity (and indirectly the connected level of urban population and share) are positively related to the dimension of main cities and also to their growth. The other important economic variable, trade openness, is instead negatively correlated with main cities' dimension and growth, because one of the main forces that build the circular causality described by Krugman is, in this case, weaker. This is, *per se*, a result that can be correlated with a performing general structure of the urban system. (2) Dimension and growth of main cities are positively correlated with bad politics and with weak institutional systems. High concentration of power impels rural-urban migration towards main cities (usually capital cities) due to the presence of insecurity and other institutional elements that affect the hinterland, creating a much more hierarchical urban landscape. In defining institutional characteristics, also historical events matter; for example colonial regimes, in particular the Spanish, have created conditions that have led to greater dimensions of main cities; because colonial settlements (especially viceroy cities) combined both political power and trade flows concentration. We think that if this tendency is maintained, probably most emerging regions will be facing increasing non-performing urbanization processes.

2. Emerging urbanization processes of <u>large agglomerations</u> (Mega and Big cities) seem to be in prevalence of the "non-performing" type. Growth of large agglomerations is not linked to economic growth (the change in GDP per capita in the period considered has a negative coefficient: the less you have grown, the greater the dimension or growth of giant cities); another economic and institutional variable, the weight of informal economy has instead a positive coefficient. In this sense, our findings are coherent with Hoselitz's (1957) hyper-urbanization model and Harris and Todaro's (1970) explanation of rural-urban migration. Only the dimension of the countries, measured by the extension of land (and related

transport/migration costs) reduces their unrestrainable growth. Large agglomerations are growing in presence of dysfunctional markets, which generate highly negative pecuniary externalities and few positive technological ones. Hence, the "planning" idea to create large agglomerations in developing countries to enhance economic development is at least debatable, because there is no evidence that large urbanization in developing countries is of performing type. Emerging giant cities are generating a sort of urbanization "lock-in" which can diminish the positive effects of urbanization on growth.

3. The drivers that expand Midsize cities are cumbersome. In general, this group of cities (of a dimension from 1.5 million inhabitants to 5 million) seems to be connected to economic backwardness (no link with variables of economic growth and structural maturity); they show a path similar to that of most main cities in developing regions (non-performing urbanization process).

4. Small cities seem linked to performing urbanization processes. Economic variables, positive changes in GDP per capita, structural economic maturity and trade (openness) are positively linked to their dimension and growth. Also the presence of good regimes (and institutions) increase their size. We think that small cities work as "intermediate cities" in an equilibrated urban system, connecting the hinterland with more large agglomerations. Hence, we think that more attention should be given to this type of cities for pursuing less hierarchical urban structures and to avoid non-performing urbanization processes. However, there are also signs that these cities, due to their economic success, are prone to suffer traumatic jumps.

5. We found indications that the urban structure that fits better with economic growth is a polycentric one. The analysis shows that to achieve a performing urbanization process two main characteristics are required: high urbanization rates *and* a low hierarchical urban structure, enhancing at the same time the development of economies of scale that any industrialization process requires, and avoiding congestion costs of large agglomeration and too hierarchical urban systems.

6. Urban structure matters for economic growth. Most economic activities today and tomorrow will be urban-based. This justifies the need to study the urban structure as a determinant of economic growth. We think that this is worthy in urban policies, especially for developing countries which are facing unexpected growth in their main cities and can lose some of the possible benefits of a well-performed urban growth.
   In fact, urbanization will continue to expand in the forthcoming years, particularly among developing countries, but an increasing and unlimited growth of cities dimensions is not linked to economic development; new urban giants are like "Romes without Empires" (Bairoch, 1988), and poorly managed urbanization processes can seriously affect economic efficiency; large negative pecuniary

externalities can overcome positive technological ones, high costs of housing and transport, increasing slums, environmental damage and economic inequality can accompany large agglomeration growth in developing countries.

We have found in our analysis that the effect of urban systems on economic development and growth is positive when urban structure is well-behaving, that is non-concentrated; we found also that large agglomerations (measured by primacy) are not linked to growth.

If these are the patterns, we consider that more attention should be given to encourage less hierarchical urban structures, where deconcentration of power seems to be the first urgent task.

7. Finally, to achieve more consistent results, not only better dependent and independent variables would be required, but also an analysis about deeper historical, institutional and social perspectives should be required, because some (important) dimensions of each urban reality can be well understood only through an interdisciplinary approach.

Appendix 3.1.

Results of our regressions

Table A.3.2. Ades and Glaeser revisited

Dependent Variable: log average **Pop. Main Cities** 1960-20	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
(Constant)	3,783	1,325	2,504	3,309	2,468	2,471	2,113	1,942	3,892	3,973
	(2,054)	(0,548)	(0,948)	(1,693)	(1,391)	(1,387)	(1,174)	(1,079)	(2,395)	(2,723)
Dummy_cap	-,064	,017	-,081	-,091						
	(-0,322)	(0,082)	(-0,307)	(-0,430)						
LNavgnonurbpop60_00	,270	,270	,351	,295	,261	,258	,270	,290	,264	,236
	(2,463)	(2,424)	(2,303)	(2,611)	(2,461)	(2,409)	(2,537)	(2,708)	(2,474)	(2,285)
LNavgpopurboutmain60_00	,303	,298	,263	,289	,296	,296	,303	,269	,303	,361
	(2,781)	(2,653)	(1,679)	(2,634)	(2,983)	(2,973)	(3,047)	(2,633)	(3,030)	(3,673)
LN_landareasqkm	-,020	-,016	-,104	-,017						
	(-0,387)	(-0,283)	(-1,135)	(-0,336)						
LNavgpcGDP60_00	,299	,470	,490	,320	,416	,429	,421	,483	,263	,207
	(1,978)	(2,739)	(2,378)	(1,951)	(2,736)	(2,744)	(2,774)	(3,142)	(1,811)	(1,597)
avgAgr_GDP60_00	-,015	-,015	-,018	-,018	-,014	-,014	-,013	-,012	-,016	-,013
	(-1,969)	(-1,609)	(-1,579)	(-1,967)	(-1,858)	(-1,848)	(-1,714)	(-1,670)	(-2,099)	(-1,758)
avg_trade60_00	-,005	-,007	-,005	-,005	-,005	-,006	-,005	-,005	-,005	-,003
	(-2,247)	(-2,483)	(-1,615)	(-2,116)	(-2,373)	(-2,360)	(-2,311)	(-2,265)	(-2,251)	(-1,066)
avgPolity_6000	-,041	-,034	-,044	-,039	-,029	-,028	-,034	-,035	-,033	-,026
	(-3,193)	(-2,448)	(-2,386)	(-2,897)	(-2,257)	(-2,074)	(-2,488)	(-2,666)	(-2,663)	(-2,039)
avgExec_6000	,004	,005	,008	,005						
	(0,724)	(0,859)	(0,789)	(0,927)						
Informeco_GDP		,009		,006						
		(1,489)		(0,998)						
LNavgFMP_6000		,040								
		(0,3649)								
avgDens_road6000			,012							
			(1,065)							
avgDens_rail6000			-,585							
			(-1,301)							
AFR	,035	,450	,372		,453	,434	,455	,504		
	(0,1543)	(1,503)	(1,051)		(1,706)	(1,601)	(1,717)	(1,870)		
LAC	,537	,701	,740		,765	,719	,741	,813		
	(2,704)	(2,719)	(2,426)		(3,570)	(2,918)	(3,448)	(3,813)		
ASIME		,537	,420		,447	,421	,397	,549		
		(2,263)	(1,371)		(2,186)	(1,952)	(1,898)	(2,648)		
WEUOFF						-,097				
						(0,386)				
Nearcoast							,002			
							(1,125)			
Ruggedness								-,072		
								(-1,302)		
Desert								-,014		
						(-0,386)		(-1,909)		
Colon_SP				,464					,504	
				(2,242)					(2,645)	
Colon_GB				-,168					-,215	
				(-0,990)					(-1,368)	
Colon_FR				,166					,155	
				(0,764)					(0,749)	
Common										-,550
										(-2,238)
Civil										,012
										(0,052)
Socialist										-,468
										(-1,771)
Number of observations	117	112	87	112	117	117	117	117	117	117
Ajusted R square	0,743	0,752	0,695	0,748	0,757	0,756	0,758	0,763	0,756	0,763

t-statistic in parenthesis

Source: Urban dataset, our elaboration.

Note: Most averages of variables are of their 1960, 1970, 1980, 1990, 2000 observations.

Table A.3.5. Drivers behind the dimension of main cities that belong to countries with middle income

Dependent Variable: log average **Pop. Main Cities** that belong to the **Middle Income group** 1960-2000	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(Constant)	4,977	5,594	7,825	4,641	1,536	2,093	2,744	,808
	(1,887)	(2,220)	(2,010)	(1,866)	(0,421)	(0,737)	(0,793)	(0,267)
Dummy_cap	,177	,283	-,010	,338	,276	,398	,134	,384
	(0,540)	(0,897)	(-0,029)	(1,0990)	(0,894)	(1,334)	(0,448)	(1,578)
LNavgnonurbpop60_00	,041	,216	,198	,178	,227	,067	,273	,438
	(0,219)	(1,096)	(0,822)	(0,925)	(1,260)	(0,351)	(1,454)	(2,657)
LNavgpopurboutmain60_00	,475	,432	,500	,449	,412	,451	,440	,323
	(2,530)	(2,408)	(2,073)	(2,575)	(2,400)	(2,496)	(2,654)	(2,238)
LN_landareasqkm	-,069	-,153	-,368	-,155	-,093	-,031	-,146	-,160
	(-0,885)	(-1,813)	(-3,266)	(-1,903)	(-0,986)	(-0,277)	(-1,905)	(-2,505)
LNavgpcGDP60_00	,349	,610	,650	,656	,697	,716	,701	,742
	(1,312)	(2,169)	(1,892)	(2,383)	(2,265)	(2,742)	(2,416)	(3,267)
avgAgr_GDP60_00	,009	,006	-,012	,012	,024	,016	,008	-,002
	(0,516)	(0,343)	(-0,628)	(0,721)	(1,336)	(0,987)	(0,509)	(-0,173)
avg_trade60_00	-,012	-,010	-,008	-,011	-,006	-,010	-,006	-,005
	(-3,834)	(-3,210)	(-1,878)	(-3,482)	(-1,668)	(-3,385)	(-1,742)	(-1,718)
avgPolity_6000	-,026	-,026	-,033	-,038	-,044	-,054	-,031	-,026
	(-1,566)	(-1,635)	(-1,656)	(-2,292)	(-2,619)	(-2,876)	(-1,794)	(-1,968)
avgExec_6000	,008	,008	-,026	,009	,007	,017	,007	,010
	(1,097)	(1,134)	(-1,363)	(1,349)	(0,999)	(2,172)	(1,005)	(1,827)
LNavgFMP_6000		-,302	-,299	-,266	-,162	-,152	-,267	-,224
		(-2,102)	(-1,427)	(-1,811)	(-0,933)	(-0,953)	(-1,823)	(-1,561)
avgDens_rail6000			-,806					
			(-1,135)					
Informeco_GDP				,011	,003	,014	,005	,008
				(1,350)	(0,316)	(1,627)	(0,545)	(1,057)
LAC					,712			
					(2,242)			
AFR					-,034			
					(-0,070)			
ASIME					,051			
					(0,163)			
Nearcoast						,003		
						(0,842)		
Rugged						,285		
						(1,816)		
Desert						-,012		
						(-0,818)		
Colon_SP							,558	
							(2,137)	
Colon_GB							-,001	
							(-0,002)	
Colon_FR							,663	
							(1,491)	
Civil								,810
								(3,343)
Common								-,009
								(-0,029)
Number of observations	40	40	30	39	39	39	39	39
Ajusted R square	,788	,809	,793	,825	,857	,844	,848	,893

t-statistic in parenthesis | Source: Urban dataset, our elaboration.

Note: Most averages of variables are of their 1960, 1970, 1980, 1990, 2000 observations.

Table A.3.6. Drivers behind the dimension of main cities that belong to countries with low income

Dependent Variable: log average **Pop. Main Cities** that belong to the **Low Income group** 1960-2000	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(Constant)	6,165	12,215	11,579	8,679	6,015	11,693	11,078	6,210
	(2,936)	(3,157)	(2,682)	(1,637)	(1,192)	(2,641)	(2,403)	(1,352)
Capital city dummy	,239	,216	,187	,374	,184	,225	,183	,215
	(0,849)	(0,785)	(0,624)	(1,158)	(0,653)	(0,736)	(0,621)	(0,758)
log average Non Urban Population	,121	,043	,090	,032	,287	,139	,154	,219
	(0,683)	(0,245)	(0,466)	(0,159)	(1,491)	(0,689)	(0,774)	(1,219)
log average Urban Pop. Outside Main City	,407	,507	,502	,554	,308	,503	,544	,321
	(2,186)	(2,678)	(2,550)	(2,768)	(1,528)	(2,507)	(2,622)	(1,704)
log of Land Area	,002	-,054	-,060	-,068	,019	-,084	-,109	,072
	(0,0219)	(-0,642)	(-0,683)	(-0,773)	(0,158)	(-0,935)	(-1,219)	(0,870)
log average GDP per Capita	,033	,086	,083	,274	,251	,031	-,045	,300
	(0,1369)	(0,367)	(0,347)	(1,029)	(1,081)	(0,113)	(-0,166)	(1,084)
average Share of Agriculture in GDP	-,023	-,023	-,025	-,023	-,020	-,026	-,021	-,019
	(-2,840)	(-2,918)	(-2,587)	(-2,282)	(-2,061)	(-2,540)	(-2,154)	(-2,268)
average Share of Trade in GDP	-,002	-,003	-,001	-,003	,003	,000	,004	,002
	(-0,621)	(-0,977)	(-0,323)	(-0,643)	(0,600	(-0,004)	(0,718)	(0,445)
average Political Regime	-,019	-,027	-,040	-,030	-,050	-,032	-,034	0,009[1]
	(-0,740)	(-1,052)	(-1,486)	(-1,102)	(-1,981)	(-1,148)	(-1,249)	(2,796)
average Political Executive Recruitment	,003	,004	,004	,003	,002	,004	,005	
	(0,546)	(0,623)	(0,577)	(0,494)	(0,312)	(0,653)	(0,701)	
log average Foreing Market Potentional		-,458	-,477	-,386	-,278	-,501	-,467	-,269
		(-1,842)	(-1,846)	(-1,291)	(-0,962)	(-1,783)	(-1,753)	(-1,038)
average Share Informal Economy in GDP			,007	,005	,008	,008	,009	
			(0,786)	(0,611)	(0,963)	(0,979)	(1,055)	
LAC				,219				
				(0,437)				
AFR				,706				
				(1,441)				
ASIME				,553				
				(1,224)				
Nearcoast					,006			
					(1,911)			
Rugged					-,123			
					(-1,799)			
Desert					-,005			
					(-0,368)			
Colon_SP						-,052		
						(-0,167)		
Colon_GB						-,257		
						(-1,111)		
Colon_FR						,107		
						(0,443)		
Civil							-,012	
							(-0,0186)	
Common							-,477	
							(-0,719)	
Socialist							-,284	
							(-0,397)	
Number of observations	54	54	50	50	50	50	50	45
Ajusted R square	,746	,759	,768	,768	,799	,766	,778	,792

t-statistic in parenthesis

Source: Urban dataset, our elaboration.

[1] In regression (8) instead of the political regime variable, we use the autocracy variable (year 1970)

Table A.3.7.a Drivers behind the dimension of Mega and Big cities *à la* Glaeser

Dependent Variable: log average **Pop. Mega & Big Cities**	(1)
(Constant)	13,059 (6,114)
LNavgnonurbpop60_00	,152 (0,954)
LNavgpopurboutmain60_00	-,077 (-0,431)
LNavgpcGDP60_00	,221 (1,314)
avgAgr_GDP60_00	-,018 (-1,122)
avg_trade60_00	-,007 (-1,077)
avgPolity_6000	-,005 (-0,410)
Number of observations	39
Ajusted R square	,299

t-statistic in parenthesis

Note: Most averages of variables are of their 1960, 1970, 1980, 1990, 2000 observations.

Table A.3.7.b Drivers behind the dimension of Mega and Big cities *à la* Henderson

Dependent Variable: log average **Pop. Mega & Big Cities**	(1)
(Constant)	-19,287 (-1,442)
LNnonurbp_60	2,565 (2,258)
LNnonurbp_602	-,069 (-2,121)
LN_landareasqkm	,046 (0,528)
LNpcGDP_60	2,386 (1,411)
LNpcGDP_602	-,137 (-1,244)
avgPolity_6000	-,007 (-0,474)
avg_trade60_00	-,001 (-0,143)
Informeco_GDP	-,004 (-0,405)
LNavgFMP_6000	,066 (0,452)
Number of observations	40
Ajusted R square	,217

t-statistic in parenthesis

Note: Most averages of variables are of their 1960, 1970, 1980, 1990, 2000 observations.

Table A.3.8. Change in Population in Mega and Big cities (1960-2000)

Dependent Variable: **Change Population 1960-2000 in Mega and Big cities** (log PopCity00- log PopCity60)	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(Constant)	12,624	2,361	5,102	8,560	7,802	4,318	4,319
	(0,946)	(0,255)	(2,465)	(3,889)	(2,811)	(1,945)	(1,801)
LNnonurbp_60	,252	,896					
	(0,223)	(0,832)					
LNnonurbp_602	-,006	-,018					
	(-0,178)	(-0,612)					
shnonurbp_60			1,798		4,234	2,299	1,837
			(0,921)		(1,597)	(1,096)	(0,665)
shnonurb602			-,004		-1,103	-,522	-,046
			(-0,002)		(-0,590)	(-0,294)	(-0,018)
LN_landareasqkm	-,382	-,435	-,187	-,295	-,295	-,176	-,160
	(-4,436)	(-4,606)	(-3,411)	(-4,877)	(-3,333)	(-2,989)	(-1,930)
LNpcGDP_60	-,968						
	(-0,574)						
LNpcGDP_602	,052						
	(0,470)						
ChLNpcGDP00_LNpcGDP60		-,364	-,328	-,134	-,254	-,287	-,278
		(-2,854)	(-3,330)	(-1,261)	(-2,204)	(-2,787)	(-2,011)
avgPolity_6000	-,019	-,017	,001	-,008	,000	-,004	-,004
	(-1,318)	(-1,398)	(0,143)	(-0,621)	(-0,028)	(-0,322)	(-0,276)
avg_trade60_00	-,018	-,004	-,005	-,012	-,008	-,004	-,005
	(-2,418)	(-0,554)	(-0,931)	(-1,917)	(-1,236)	(-0,671)	(-0,814)
Informeco_GDP	,023	,022	,016	,021	,009	,016	,016
	(2,366)	(3,424)	(3,064)	(3,190)	(1,285)	(2,780)	(2,849)
LNavgFMP_6000	-,337	-,389	-,180	-,260	-,297	-,151	-,155
	(-2,297)	(-2,755)	(-1,69)	(-1,980)	(-2,230)	(-1,351)	(-1,347)
Nearcoast		-,004					
		(-1,087)					
Desert		-,006					
		(-0,354)					
Rugged		,108					
		(0,936)					
Lowincome_00				,469			
				(3,097)			
Highincome_00				-,150			
				(-0,556)			
LAC					-,239		
					(-0,796)		
AFR					-,305		
					(-0,659)		
ASIME					-,733		
					(-1,486)		
Colon_SP						,098	
						(0,532)	
Colon_GB						,225	
						(1,521)	
Colon_FR						,175	
						(0,438)	
Common							,066
							(0,271)
Civil							,028
							(0,141)
Socialist							-,143
							(-0,349)
Number of observations	40	40	40	40	40	40	40
Ajusted R square	,626	,693	,785	,697	,785	,783	,767

t-statistic in parenthesis — Source: Urban dataset, our elaboration.

Note: Most averages of variables are of their 1960, 1970, 1980, 1990, 2000 observations.

Table A.3.9. Drivers behind the dimension of Midsize cities (1960-2000) considering different "types" of midsize

Dependent Variable: log average **Pop. Midsize Cities** 1960-2000	All Midsize (main & non main)	Midsize (main)	Midsize (non main)
	(1)	(2)	(3)
(Constant)	12,082	10,103	11,764
	(12,434)	(7,465)	(8,576)
LNavgnonurbpop60_00	-,036	,015	-,078
	(-0,436)	(0,132)	(-0,646)
LNavgpopurboutmain60_00	,134	,230	,239
LNnonurbp_60	(1,499)	(2,121)	(1,647)
LNnonurbp_602			
LN_landareasqkm	-,073	-,080	-,083
	(-2,228)	(-1,850)	(-1,944)
LNavgpcGDP60_00	,172	,208	,094
	(2,089)	(1,983)	(0,781)
LNpcGDP_60			
LNpcGDP_602			
avgAgr_GDP60_00	-,001	,002	-,005
	(-0,127)	(0,306)	(-0,417)
avg_trade60_00	,002	-,005	,004
	(0,678)	(-1,592)	(1,097)
avgPolity_6000	-,010	-,005	-,007
	(-1,426)	(-0,410)	(-0,697)
avgExec_6000	,010	,006	,002
	(2,105)	(1,143)	(0,267)
Number of observations	175	34	141
Ajusted R square	,273	,658	,233

t-statistic in parenthesis

Note 1: Most averages of variables are of their 1960, 1970, 1980,

Table A.3.10. Change in Population in Midsize cities "non main" (1960-2000)

Dependent Variable: **Change Population 1960-2000** in **"non-main" Midsize cities** (log PopCity00- log PopCity60)	(4)	(5)	(6)	(7)
(Constant)	4,895 (4,550)	9,985 (5,454)	10,121 (5,488)	9,024 (4,939)
LNnonurbp_60	-,237 (-4,019)	-,314 (-6,840)	-,383 (-6,499)	-,177 (-2,097)
LN_landareasqkm	,026 (0,472)	,051 (1,084)	,127 (2,232)	-,053 (-0,588)
LNpcGDP_60			-,509 (-2,904)	-,439 (-2,441)
LNavgpcGDP60_00		-,446 (-3,092)		
ChLNpcGDP00_LNpcGDP60	-,132 (-0,925)			
avgAgr_GDP60_00	,034 (5,530)	,006 (0,549)	,010 (0,849)	-,006 (-0,475)
avgPolity_6000	-,012 (-1,211)	,002 (0,200)	,014 (0,863)	,045 (2,508)
avgExec_6000			,002 (0,147)	-,012 (-0,881)
avg_trade60_00	-,010 (-1,956)	-,012 (-2,722)	-,009 (-1,678)	-,003 (-0,536)
Dens_rail00				-1,904 (-3,751)
Common				
Civil				
Socialist				
Number of observations	139	140	139	131
Ajusted R square	,333	,376	,378	,447

t-statistic in parenthesis
Source: Urban dataset, our elaboration.
Note: Most averages of variables are of their 1960, 1970, 1980, 1990, 2000 observations.

Table A.3.11. Change in Population of Small cities non-main (1960-2000)

Dependent Variable: **Change Population 1960-2000 Small cities** (log PopCity00- log PopCity60)	(1)	(2)	(3)
(Constant)	4,721	3,117	4,363
	(5,0110)	(2,861)	(4,054)
LNnonurbp_60	-,008	-,105	-,012
	(-0,127)	(-1,532)	(-0,187)
avg_trade60_00	,007	,012	,008
	(1,691)	(2,860)	(1,811)
avgAgr_GDP60_00	,006	,003	,008
	(0,877)	(0,359)	(1,077)
LN_landareasqkm	-,237	-,065	-,206
	(-2,949)	(-0,752)	(-2,308)
Dens_rail60	-1,892	-1,100	-1,851
	(-6,734)	(-3,368)	(-5,691)
Polity_60	,040	,049	,049
	(6,001)	(7,060)	(5,353)
ChLNpcGDP00_LNpcGDP60	,271	,348	,241
	(2,214)	(2,690)	(1,563)
Nearcoast	-,009	-,010	-,009
	(-4,175)	(-4,662)	(-4,347)
LAC		,627	
		(3,766)	
AFR		,465	
		(2,035)	
ASIME		,703	
		(3,915)	
Colon_SP			-,015
			(-0,075)
Colon_GB			-,170
			(-1,332)
Colon_FR			-,058
			(-0,219)
Number of observations	290	290	290
Ajusted R square	,364	,407	,361

*** significant at 99%; ** significant at 95%; * significant at 90%; ns: non significant

Note: Most averages of variables are of their 1960, 1970, 1980, 1990, 2000values.

Source: Urban dataset, our elaboration

Table. A.3.13. Urban structure, deep determinants and their effect on GDP per Capita (1960-2000)

Dependent Variable: log GDP per Capita 2000	(1)	(2)	(3)	(4)	(5)	(6)
(Constant)	1,670	1,210	2,827	3,957	4,590	7,202
	(1,794)	(1,156)	(2,886)	(4,383)	(3,127)	(6,305)
shurb_60	,017	,016	,017	,011	,007	,003
	(2,828)	(2,654)	(2,863)	(2,082)	(1,048)	(0,556)
LNpcGDP_60	,720	,792	,560	,483	,521	,216
	(4,999)	(5,334)	(3,740)	(3,614)	(3,345)	(1,756)
Zipf_95W	,655	,724	,600	,382	,595	,585
	(2,136)	(1,901)	(1,995)	(1,431)	(1,859)	(2,462)
AvgPrimacy2_6000 (1/2+3)		-,049			-,023	-,017
		(-0,988)			(-2,736)	(-2,733)
LAC			-,078			
			(-0,411)			
WEUOFF			,554			
			(2,447)			
AFR				-,711		
				(-4,668)		
WEUOFF				,661		
				(3,654)		
avg_trade60_00					-,001	-,001
					(-0,358)	(-0,574)
avgPolity_6000					,034	,004
					(2,228)	(0,356)
LN_landareasqkm					-,036	-,035
					(-0,684)	(-0,879)
Highincome_00						,728
						(4,443)
Lowincome_00						-,912
						(-6,371)
Number of observations	86	77	86	86	78	78
Ajusted R square	,764	,775	,781	,827	,812	,897

t-statistic in parenthesis Source: Urban dataset, our elaboration.

Note: Most averages of variables are of their 1960, 1970, 1980, 1990, 2000 observations.

Table A.3.14. Urban structure and growth in high income countries

Dependent Variable: log GDP per Capita 2000	(1)
	(11,618)
shurb_60	,001
	(0,211)
LNpcGDP_60	,123
	(1,180)
Zipf_95W	,185
	(0,749)
Number of observations	22
Ajusted R square	,101

t-statistic in parenthesis

Source: Urban dataset, our elaboration.

Table A.3.15. Urban structure and growth in cities that belong to middle and low income countries

Dependent Variable: log GDP per Capita 2000	(1)	(2)	(3)	(4)	(5)	(6)
(Constant)	1,670	1,210	2,827	3,957	4,590	7,202
	(1,794)	(1,156)	(2,886)	(4,383)	(3,127)	(6,305)
shurb_60	,017	,016	,017	,011	,007	,003
	(2,828)	(2,654)	(2,863)	(2,082)	(1,048)	(0,556)
LNpcGDP_60	,720	,792	,560	,483	,521	,216
	(4,999)	(5,334)	(3,740)	(3,614)	(3,345)	(1,756)
Zipf_95W	,655	,724	,600	,382	,595	,585
	(2,136)	(1,901)	(1,995)	(1,431)	(1,859)	(2,462)
AvgPrimacy2_6000 (1/2+3)		-,049			-,023	-,017
		(-0,988)			(-2,736)	(-2,733)
LAC			-,078			
			(-0,411)			
WEUOFF			,554			
			(2,447)			
AFR				-,711		
				(-4,668)		
WEUOFF				,661		
				(3,654)		
avg_trade60_00					-,001	-,001
					(-0,358)	(-0,574)
avgPolity_6000					,034	,004
					(2,228)	(0,356)
LN_landareasqkm					-,036	-,035
					(-0,684)	(-0,879)
Highincome_00						,728
						(4,443)
Lowincome_00						-,912
						(-6,371)
Number of observations	86	77	86	86	78	78
Ajusted R square	,764	,775	,781	,827	,812	,897

t-statistic in parenthesis Source: Urban dataset, our elaboration.

Note: Most averages of variables are of their 1960, 1970, 1980, 1990, 2000 observations.

Table A.3.16. Urban structure and growth considering different countries' income level
(dependent variable: *change* in GDP per capita)

Dependent Variable:	All Income levels		Low & Middle Income
Change GDP per Capita 1960-2000 ln(GDPcap. 00)-ln(GDPcap.60)	(1)	(2)	(3)
(Constant)	5,659	4,590	4,795
	(3,363)	(3,127)	(2,355)
LNpcGDP_60	-,514	-,479	-,601
	(-3,161)	(-3,076)	(-3,199)
shurb_60	,010	,007	,023
	(1,424)	(1,044)	(2,661)
Zipf_95W	,840	,595	1,635
	(2,110)	(1,859)	(3,609)
AvgPrimacy2_6000 (1/2+3)	-,014		-,006
	(-0,289)		(-0,122)
avgAgr_GDP60_00	-,025	-,023	-,010
	(-2,732)	(-2,736)	(-0,941)
avg_trade60_00	-,004	-,001	-,002
	(-1,159)	(-0,358)	(-0,397)
avgPolity_6000	,024	,034	-,005
	(1,512)	(2,228)	(-0,302)
LN_landareasqkm	-,102	-,036	-,115
	(-1,612)	(-0,684)	(-1,398)
Number of observations	70	78	49
Ajusted R square	,262	,247	,337

t-statistic in parenthesis
Note: Averages of variables are of their 1960, 1970, 1980, 1990, 2000 observations.
Source: Urban dataset, our elaboration.

Table 3.17. Effect of Socialist law on Midsize cities

Dependent Variable: **Change Population 1960-2000** in **"non-main" Midsize cities** (log PopCity00- log PopCity60)	(1)
(Constant)	1,133 (0,753)
LNnonurbp_60	-,070 (-0,927)
LN_landareasqkm	,088 (1,320)
LNpcGDP_60	
LNavgpcGDP60_00	
ChLNpcGDP00_LNpcGDP60	-,080 (-0,534)
avgAgr_GDP60_00	,028 (4,032)
avgPolity_6000	-,038 (-2,776)
avgExec_6000	
avg_trade60_00	,000 (-0,0417)
Dens_rail00	
Common	-,128 (-0,514)
Civil	-,069 (-0,284)
Socialist	-1,009 (-3,037)
Number of observations	139
Ajusted R square	,381

t-statistic in parenthesis

Table 3.18. Drivers behind the dimension of main cities in high income countries
(using as dependent variable the change in population and as independent variable the change in GDP capita in the period analyzed)

Dependent Variable: **Change in Pop. Main Cities** that belong to the **Highe Income group** 1960-2000 ln(pop Main 2000) - ln(pop Main 1960)	(1)
Dummy_cap	1,566
	(,340)
LNavgnonurbpop60_00	,380
	(,985)
LNavgpopirnoutmain60_00	-,270
	(-1,106)
LN_landareaskm	,302
	(1,255)
ChLNpcGDP00_LNpcGDP60	,312
	(,303)
avg_Agr_GDP60_00	,051
	(1,193)
avg_Trade_GDP60_00	,000
	(-,023)
avg_Polity_GDP60_00	,136
	(,793)
avg_Exec_60_00	-,595
	(-,907
LNavgFMP_60_00	-,031
	(-,180)
avgDens_rail_60_00	,911
	(1,008)
Number of observations	19
Ajusted R square	,416

t-statistic in parenthesis

Note: Most averages variables are of their 1960, 1970, 1980, 1990, 2000 observations.

Source: Urban dataset, our elaboration.

Appendix 3.2

List of countries by income level

High Income group	Middle Income group	Low Income group
1 Australia	1 Argentina	1 Afghanisthan
2 Austria	2 Bahrain	2 Albania
3 Belgium	3 Belarus	3 Azerbaijan
4 Canada	4 Bosnia	4 Bangladesh
5 Denmark	5 Botswana	5 Benin
6 Finland	6 Brazil	6 Bolivia
7 France	7 Bulgaria	7 Burkina Faso
8 Germany	8 Chile	8 Burundi
9 Greece	9 Colombia	9 Cambodia
10 Hong Kong	10 Costa Rica	10 Cameroon
11 Ireland	11 Croatia	11 Central African Republic
12 Israel	12 Czech	12 Chad
13 Italy	13 Dominican Republic	13 China
14 Japan	14 Estonia	14 Congo Democratic Republic (Zaire)
15 Netherlands	15 Guatemala	15 Congo Republic
16 New Zealand	16 Hungary	16 Cote I'voire
17 Norway	17 Iran	17 Cuba
18 Portugal	18 Jamaica	18 DJbouti
19 Puerto Rico	19 Jordan	19 Egypt
20 Singapore	20 Kazakstan	20 El Salvador
21 South Korea	21 Kuwait	21 Equador
22 Spain	22 Latvia	22 Ethiopia
23 Sweden	23 Lithuania	23 Gambia
24 Switzerland	24 Malaysia	24 Ghana
25 United Arab Emirates	25 Mexico	25 Guinea
26 United Kingdom	26 Namibia	26 Guinea-Bissau
27 United States of America	27 Panama	27 Honduras
	28 Peru	28 India
	29 Poland	29 Indonesia
	30 Russia	30 Iraq
	31 Saudi Arabia	31 Kenya
	32 Slovakia	32 Krygzstan
	33 South Africa	33 Lebanon
	34 Sri Lanka	34 Lesotho
	35 Syria	35 Liberia
	36 Thailand	36 Madagascar
	37 Tunisia	37 Malawi
	38 Turkey	38 Mali
	39 Uruguay	39 Mongolia
	40 Uzbekistan	40 Morocco
	41 Venezuela	41 Mozambique
		42 Nepal
		43 Nicaragua
		44 Niger
		45 Nigeria
		46 Pakistan
		47 Paraguay
		48 Philippines
		49 Romania
		50 Rwanda
		51 Senegal
		52 Somalia
		53 Sudan
		54 Tajikistan
		55 Tanzania
		56 Turkmenistan
		57 Uganda
		58 Ukraine
		59 Vietnam
		60 Yemen
		61 Zambia
		62 Zimbabwe

Appendix 3.3

Results of Kim (2007)

Variables	Definition
exprop	Average protection against expropriation risk 1985-1995
mal94	Proportion of country's population at risk of falciparum malaria transmission in 1994
lt100km	Proportion of land area within 100km of he sea coast
latabs	Absolute value of latitude
sch70	Years of schooling of the total population aged over 25 in 1970
ur95	Proportion of urban population to total population in 1995
devsecmp95	Deviation of secondary ratio 1995
priurb95	Proportion of the largest city to urban population in 1995
zipflaw95	Zipf's law exponent 1995
lnCT	Log od weighted averaged one way commuting time 1995
Mfg95	Percentage of Manufacturing indstry to GDP

Source: Kim (2007)

Dependent variable: Log of GDP per capita 1995	
exprop	0,166
	(2,25)*
mal94	-0,354
	(1,19)
lt100km	0,612
	(2,65)*
latabs	0,740
	(1,36)
sch70	0,055
	(1,24)
ur95	1,840
	(3,52)**
devsecmp95	-0,369
	(1,03)
priurb95	-1,1359
	(1,14)
zipflaw95	-0,7263
	(1,26)
lnct	-0,0309
	(0,05)
mfg95	0,0007
	(0,04)
Constant	6,7671
	(3,39)**
Number of observations	39
Adjusted R^2	0,85

*significant at 5%:, ** significant at 1%

Source: Kim (2004)

Dependent variable: Avg. GDP Cap. growth rate 1991-1995	
exprop	0,001
	(0,20)
mal94	-0,030
	(1,16)
lt100km	0,014
	(0,68)
latabs	-0,033
	(0,74)
sch70	-0,001
	(0,16)
ur95	-0,047
	(0,83)
devsecmp95	0,027
	(0,97)
priurb95	0,115
	(1,34)
zipflaw95	0,093
	(1,95)
lnct	0,064
	(1,21)
mfg95	0,002
	(1,02)
Constant	-0,310
	(1,84)
Number of observations	33
Adjusted R^2	0,37

*significant at 5%:, ** significant at 1%

Source: Kim (2004)

References

Acemoglu D. *et. al.* (2004), “Institutions as the Fundamental Cause of Long-Run Growth”, *NBER*, Working Paper No.10481.

Ades A. and Glaeser E. (1995), “Trade and Circuses: Explaining Urban Giants”, *The Quarterly Journal of Economics*, vol. 110, no. 1, pp. 195-227.

Alonso W. (1971), “The Economics of Urban Size”, *Papers and Proceedings of the Regional Science Association*, 26,pp. 67–83.

Alonso W. (1964), *Location and Land Use*, Harvard University Press. Cambridge.

Anas *et. al* (1998), “Urban Spatial Structure”, *Journal of Economic Literature*, vol. 36, pp. 1426-1464.

Aristotle, *Politics*, translated by Benjamin Jowett(1999), Batoche Books.

Arthur B. (1988), “Urban Systems and Historical Path-Dependence”, *Food Research InstitutePaper* No. 0012.

Antikainen J. (2005). “The Concept of Functional Urban Areas: Findings of the ESPON Project 1.1.1.*”, Informationen zum Raumentwicklung*, Heft 7.

Auerbach, F. (1913), “Das Gesetz der Belvolkerungskoncentration” Petermanns Geographische Mitteilungen, 59:74-76.

Bairoch P. (1988), *Cities and Economic Development*, University of Chicago Press, Chicago.

Bertaud A. and Brueckner J.K. (2005), “Analyzing building-height restrictions: predicted impacts and welfare costs”, *Regional Science and Urban Economics,* vol. 35, pp. 109– 125.

Bertinelli L. and Black D. (2004), “Urbanization and Growth”, *Journal of Urban Economics*, vol. 56, pp. 80-96.

Black, D. and J.V. Henderson (1999a), "A Theory of Urban Growth", *Journal of Political Economy*, vol. 107, pp. 252-84.

Black, D. and J.V. Henderson (2003), "Urban Evolution in the USA," *Journal of Economic Geography*, vol. 3, pp. 343-373.

Böhme, K. and P. Schön (2006), “From Leipzig to Leipzig: Territorial Research Delivers Evidence for the New Territorial Agenda of the European Union”, *disP* 165, 2, pp. 61-70.

Boserup, E. (1965), *The Conditions of Agricultural Growth: The Economics of Agrarian Change under Population Pressure*. Aldine. London: Allen & Unwin, Chicago.

Breschi S. and Lissoni F. (2001), “Knowledge Spillovers and Local Innovation Systems: A Critical Survey”, *Industrial and Corporate Change*, vol. 10, no. 4, pp. 975-1005.

Campante F. and Glaeser E. (2009), "Yet Another Tale of Two Cities: Buenos Aires and Chicago", *NBER*, Working Paper No. 15104.

Canning, D. (1998), "A Database of World Stocks of Infrastructure: 1950-1995," *The World Bank Economic Review*, vol. 12, pp 529-548.

Capello R. (2004), *Economia Regionale: Localizzazione, crescita regionale e sviluppo locale,* Il Mulino, Bologna.

Castells M. (2002), "Local and Global: Cities in the Network Society", *Tijdschrift voor economische en sociale geografie*, vol. 93, 5, pp. 548–558.

CEPII - Centre de recherche français dans le domaine de l'économie international, *Databases*, available at http://www.cepii.fr/anglaisgraph/bdd/bdd.htm

Chamberlin, E. (1933), *The Theory of Monopolistic Competition*. MA: Harvard University Press, Cambridge.

Comunian, R. (2011), "Rethinking the Creative City: The Role of Complexity, Networks and Interactions in the Urban Creative Economy, *Urban Studies*, vol. 48, 6, pp. 1157–1179.

Paul C. Cheshire and Magrini S. (2006). "Population growth in European cities: Weather matters–but only nationally", *Regional Studies*, vol. 40,1, 23-37

Cheshire, P.C. and Sheppard, S. (2004). *Land markets and land market regulation: progress towards understanding* [online] London: LSE Research Online. Available at: http//eprints.lse.ac.uk/archive/00000566

Cheshire, P.C. and Magrini S. (2002). *The distinctive determinants of European urban growth: does on size fit all?* [online]. London: LSE Research Online. Available at: http//eprints.lse.ac.uk/archive/00000569

Cheshire, P.C. and Hay D.G. (1989). *Urban Problems in Western Europe: An Economic Analysis*, Unwin Hyman, London.

Christaller, W. (1933), *Die Zentralen Orte in Süddeutschland*, Jena: Gustav Fischer Verlag. Translated from German by C. W. Baskin (1966) The Central Places of Southern Germany, Englewood Cliffs, Prentice-Hall, New Jersey.

Cook, N.D., (1998). *Born to Die: Disease and New World Conquest*, Cambridge University Press, Cambridge.

Davis J. and Henderson V. (2003), "Evidence on the political economy of the urbanization process". *Journal of Urban Economics,* vol. 53, pp. 98-125.

Deininger, K. and Squire L. (1996). "A New Data Set Measuring Income Inequality", *The World Bank Economic Review*, 10(3), pp.565-91.

De Soto *et.al.* (1986). *El Otro Sendero*, Instituto Libertado y Democracia, Editorial El Barranco, Lima.

Eckstein, E. (1977), *The Poverty of Revolution,* Cambridge University Press, Cambridge.

Eeckhout J. (2004), "Gibrat's Law for (All) Cities", *The American Economic Review*, vol. 94, no. 5, pp. 1429-1451.

Erickson R. A. (1976), "The Filtering-Down Process: Industrial Location in a Non Metropolitan Area", *The Professional Geographer*, vol. 28, 3, pp. 254–260.

ESPON (2004), *Potentials for Policentric Development in Europe,* Stockholm.

ESPON (2007), *Study on Urban Functions Project 1.4.3,* Final Report, Stockholm.

Fafchamps M. (1997), "Mobile Capital, Local Externalities and Industrialization", Department of Economics, Stanford University.

Feler L. and Henderson J. (2009), "Exclusionary Policies in Urban Development: Under-Servicing Migrant Households in Brazilian Cities", Department of Economics, Brown University.

Fujita M. (1989), *Urban Economic Theory: Land Use and City Size*, Cambridge University Press, Cambridge

Fujita M. and Krugman P. (1995), "When is the Economy Monocentric? Thünen and Chamberlin Unified", *Regional Science and Urban Economics*, vol. 25, pp. 505-528.

Fujita and Mori (1996), "The Role of Ports in the Making of Major Cities: Self-agglomeration and hib-effect, *Journal of Development Economics*, vol.94, pp.93-120.

Fujita M. *et. al.* (1999), "On the Evolution of Hierarchical Urban Systems", *European Economic Review*, vol. 43, pp. 209-251.

Fujita M. et. al. (1999), *The Spatial Economy: Cities, Regions, and International Trade*, MIT Press, Cambridge.

Fujita M. (2010), "The Evolution of Spatial Economics: from Thünen to the New Economic Geography", *The Japanese Economic Review*, vol. 61, no. 1.

Florida R. *et. al.* (2008), "The Rise of Mega Regions", *Cambridge Journal of Regions, Economy and Society*, vol. 1, pp. 459–476

Gabaix X. (1999), "Zipf's Law for Cities: An Explanation", *The Quarterly Journal of Economics*, vol. 114, no. 3, pp. 739-767.

Gabaix X. and Ionnides Y. (2003), "The Evolution of City Size Distributions". *Handbook of Urban and Regional Economics*, vol. IV.

Gaviria A. and Stein E. (2000), "The Evolution of Urban Concentration around the World: a Panel Approach", Intern-American Development Bank Research Department, Washington.

Glaeser E. and Gottlieb J. (2006), "Urban Resurgence and the Consumer City". *Harvard Institute of Economic Research. Discussion Paper* No. 2109.

Glaeser E. (2005), "Urban Colossus: Why is New York America's Largest City?", *Harvard Institute of Economic Research, Discussion Paper* No. 2073.

Glaeser E. and Shapiro J. (2001), "Cities and Warfare: The Impact of Terrorism on Urban Form", *Journal of Urban Economics, symposium on terrorism and the future cities*.

Glaeser E. et. al. (2000), "Why do Poor Live in Cities?", *Harvard Institute of Economic Research Discussion Paper* No. 1891.

GRUMP, Global Rural Urban Mapping Project (GRUMP), Columbia University. http://beta.sedac.ciesin.columbia.edu/gpw/

Hall P. (1966), *The World Cities*, McGraw-Hill, New York.

Harris J. and Todaro M. (1970), "Migration, Unemployment and Development: A Two-Sector Analysis", *American Economic Review*, vol. 60, no. 1, pp. 126–142.

Helpman E. (1995), "The Size of Regions", *The Foeder Institute for Economic Research Working Paper* No. 14-95.

Henderson J. V. (1974) "The Sizes and Types of Cities", *The American Economic Review*, vol. 64, no. 4, pp. 640-656.

Henderson J. V. (2004), "Urbanization and Growth", *Handbook of Economic Growth*, vol. 1.

Henderson J. V. (1997), "Medium size cities", *Regional Science and Urban Economics*, vol. 27, pp. 583-612.

Henderson J. V. (2003), "Marshall's Scale Economies", *Journal of Urban Economics,* vol. 53, pp. 1-28.

Henderson J. V. (2002), "*World's Cities data*", Brown University, available at http://www.econ.brown.edu/faculty/henderson/worldcities.html

Henderson J. V. (2000), "The Effects of Urban Concentration on Economic Growth", *NBER,* Working Paper No. 7503.

Henderson J.V. (2010), "Cities and Development", *Journal of Regional Science,* vol. 50, 1, pp. 515-540.

Henderson J. V and Wang H. (2007), "Urbanization and City Growth: The Role of Institutions", *Regional Science and Urban Economics*, vol. 37, pp. 283-313.

Hirschman, A.O. (1958), *The Strategy of Economic Development*, Yale University Press, New Haven.

Hodge G. (1968), "Urban structure and regional development", *Papers in Regional Science*, vol. 21, 1, pp. 101-123.

Horton, F. E., and D. R. Reynolds (1971), "Effects of Urban Spatial Structure on Individual Behavior", Economic *Geography* vol. 47, 1, pp. 36-48.

Hoselitz, B.F. (1957), "Urbanization and Economic Growth in Asia". *Economic Development and Cultural Change,* vol. 6, pp. 42-54.

Huang J *et. al.* (2007), "A global comparative analysis of urban form: Applying spatial metrics and remote sensing", *Landscape and Urban Planning,* vol. 82 pp. 184–197.

ILO, "*Database on Labour Statistics*", available at http://laborsta.ilo.org/

Ionnides Y. and Overman H. (2000), "Zipf's Law for Cities: An Empirical Examination", *Journal of Economic Literature*, R00, C14.

Institut national de la statistique et des études économiques (Insee). Définitions et methods. Information available at http://www.insee.fr/fr/methodes/.

Jacobs J., (1969), *The Economy of Cities*, Random House, New York.

Junius K. (1999), "Primacy and Economic Development: Bell Shaped or Parallel Growth of Cities?", *Journal of Economic Development*, vol. 24, no. 1.

Kelley A.C. and J. Williamson (1984), *What Drivers Third World City Growth? A Dynamic General Equilibrium Approach,* Princeton University Press, New Jersey.

Kim D. (2007), *Urbanization and Economic Growth: The Effects of Urban Structure,* Diss. Columbian College of Arts and Science of The George Washington University, Washington.

Krugman P. (1991), "Increasing Returns and Economic Geography". *The Journal of Political Economy*, vol. 99, no. 3, pp. 483-499.

Krugman P. (1991), "First Nature, Second Nature, and Metropolitan location", *NBER,* Working Paper No. 3740.

Kuznets S. (1955), "Economic Growth and Income Inequality", *The American Economic Review*, vol. 45,1, pp.1-28.

Krugman P. (1996), "Confronting the Mystery of Urban Hierarchy", *Journal of the Japanese and International Economies*, vol. 10, pp. 399 – 418.

Krugman P. and Livas R. (1992), "Trade Policy and the Third World Metropolis", *Bureau of Economic Research,* Working Paper No. 4238.

Lee B. and Gordon P. (2007), "Urban Spatial and Economic Growth in US Metropolitan Areas", *Western Regional Science Association*.

Le Maitre, Alexandre B. (1682), *La métropolitée, ou del'établissement des villes capitales, de leur utilité´ passive et active, de l'union de leurs parties et de leur anatomie, de leur commerce*. [Publisher: Amsterdam, Ches B. Boekhold, Pour J. Van Grop]: Editions d'histoire sociale. Paris:1973, vol. 17,pp. 192.

Lewis W. A. (2009), "*Ethnologue Enclyclopedia Languages of the World*" 16th Edition, Dallas, available at http://www.ethnologue.com/.

Lewis M. P. (1954), "Economic Development with Unlimited Supplies of Labour", *The Manchester School*, vol. 22, Issue 2, pp. 139-191.

Lösch, A. (1954), *The Economics of Location*, Yale University Press, New Haven.

Maddison, A. (2010), *Statistics on World Population: GDP and Per Capita GDP*, Groningen, available at http://www.ggdc.net/MADDISON/oriindex.htm.

Marshall A. (1890), *Principles of Economics*, publisher Macmillan and Co. Ltd., London.

McKinsey Global Institute (2009), *Preparing for China's Urban Billion*, McKinsey & Company.

Meoño J. (2009), “Descentralización integral para el desarrollo de Costa Rica”, *Instituto de Investigaciones Económicas*, Universidad de Costa Rica.

Mieszkowski P. and Mills E. (1993), “The Causes of Metropolitan Suburbanization”, *The Journal of Economic Perspectives*, vol. 7, 3, pp. 135-147.

Monty G. *et. al.* (2010), Polity IV Project: Political Regime Characteristics and Transitions, 1800-2010, *Societal-Systems Research Inc. and Colorado State University*, available at http://www.systemicpeace.org/inscr/inscr.htm

Mori T. (1997), “A Modeling of Megalopolis Formation: The Maturing of City Systems”, *Journal of Urban Economics*, vol. 42, pp. 133 - 57.

Nijkamp P. (1980), “Perspectives for Urban Analyses and Policies”, Department of Economics, University of Amsterdam.

Nunn N. and Puga D. (2012). Database of “Ruggedness: The blessing of bad geography in Africa”, *Review of Economics and Statistics* vol. 94,1, pp. 20-36, available at http://diegopuga.org/data/rugged/

Nunn N. and Qian N. (2010), “The Columbian Exchange: A history of Disease, Food and Ideas”, *Journal of Economic Perspectives*, vol. 24, no. 2, pp. 163-188.

OECD (2010), “*Trends in Urbanization and Urban Policies in OECD: What Lessons for China?*”, Paris.

Ottaviano G. and Thisse J. (2001), “On economic geography in economic theory: increasing returns and pecuniary externalities”, *Journal of Economic Geography*, Vol. 1, pp. 153-179.

Rodrick *et. al.* (2004), “Institutions Rule: The Primacy of Institutions Over Geography and Integration in Economic Development” *Journal of Economic Growth*, vol. 9, pp. 131 – 165.

Romer P. (2010), “Technologies, Rules and Progress: The Case for Charter Cities”, *Center for Global Development*, code: 1423916.

Rosen K. and Resnick M. (1980), “The Size Distribution of Cities: An Examination of the Pareto Law and Primacy”, *Journal of Urban Economics*, vol. 8, pp. 165-186.

Rossi-Hansberg E. and Wright M. (2007), “Urban Structure and Growth”, *Review of Economic Studies*, vol. 74, pp. 597 – 624.

Plato, *Laws,* Translated by Benjamin Jowett, The Internet Classics Archive, http://classics.mit.edu//Plato/laws.html.

Rostow W. (1960), *The Stages of Economic Growth: A Non-Communist Manifesto*, Cambridge University Press, Cambridge.

Samuelson P. (1983), *Foundations of Economic Analysis*, Harvard University Press.

Sassen S. (2001), *The Global City*, Princeton University Press, New Jersey.

Simmons A.B. (1979), “Slowing Metropolitan City Growth in Asia: Policies, Programs and Results”, *Population and Development Review*, vol.5,1,pp.87-104.

Scitovsky T. (1954), “Two concepts of external economies”, *Journal of Political Economy,* 62, pp. 143-151.

Schumacher E.F.(1975) No future for Megapolis. Vol.5,5. Avaiable at: http://www.swaraj.org/shikshantar/schumacher_megapolis.htm

Scott A.J. (2001), “Globalization and the Rise of City-regions”, *European Planning Studies*, vol. 9, 7, pp. 813-826.

Simon H. (1955), “On a Class of Distribution Functions”, Biometrika, vol. 42, 3/4, pp. 425 – 440.

Short J.R. and L.M. Pinet-Peralta (2009), “Urban Primacy: Reopening the Debate”, *Geography Compass*, vol.3,3, pp. 1245-1266.

Smith A. (1776), *An Inquiry into the Nature and Causes of the Wealth of Nations*, Edwin Cannan, ed. London: Methuen & Co., Ltd. 1904. Library of Economics and Liberty, http://www.econlib.org/library/Smith/smWN.html.

Solow R. (1956), "A Contribution to the Theory of Economic Growth", *Quarterly Journal of Economics,* vol. 70,1, pp. 65-94.

Soo, K.T. (2005),“Zipf’s Law for Cities: A Cross-country Investigation”. Regional Science and Urban Economics, vol. 35, pp. 239-263.

Stiglitz J.E. (1985), “Economics of information and the theory of economic development”, *NBER*, Working Paper No. 1566.

Todaro M. (1969), “A Model of Labor Migration and Urban Unemployment in Less Developed Countries”, *The American Economic Review*, vol. 59, no. 1, pp. 138 – 148.

Van der Panne G. and van Beers C. (2006), “On the Marshall – Jacobs Controversy: It Takes Two to Tango”, *Delft Innovation System Papers*, Delft University of Technology, Jaffalaan.

Van der Ploeg F. and Poelhekke S. (2008), “Globalization and the rise of Mega Cities in the Developing World”, *Cambridge Journal of Regions, Economy and Society*, vol. 1, pp. 477-501.

Von Thünen J. H. (1826), *Der Isolierte Staat in Beziehung Auf Landwirtschaft Und Nationalökonomie*, Hamburg: Perthes. Translated from German by C. M. Wartenberg (1966) Von Thünen’s Isolated State, Oxford: Pergamon Press.

United Nation (1974)*. Manual VIII. Methods for projections of urban and rural population,* United Nations publication, Sales *No. E.74.XIII.3*No. E.74.XIII.3*.*

Wheaton W. and Shishido H. (1981), “Urban Concentration, Agglomeration Economies and the Level of Economic Development*”, Economic Development and Cultural Change*, vol. 30, no. 1, pp. 17-30.

Wolman, A. (1965), “The metabolism of cities”, *Scientific American*, vol. 213,3, pp. 179-190.

World Bank (2009), *The World Development Report: reshapes economic geography': geographical reflections*, Oxford University Press, New York.

World Bank, *The Online World Bank Data Catalog*, available at http://data.worldbank.org/data-catalog.

Zipf G.K. (1949), *Human Behaviour and the Principle of Least Effort*. Addison-Wesley, Reading, Massachusetts.