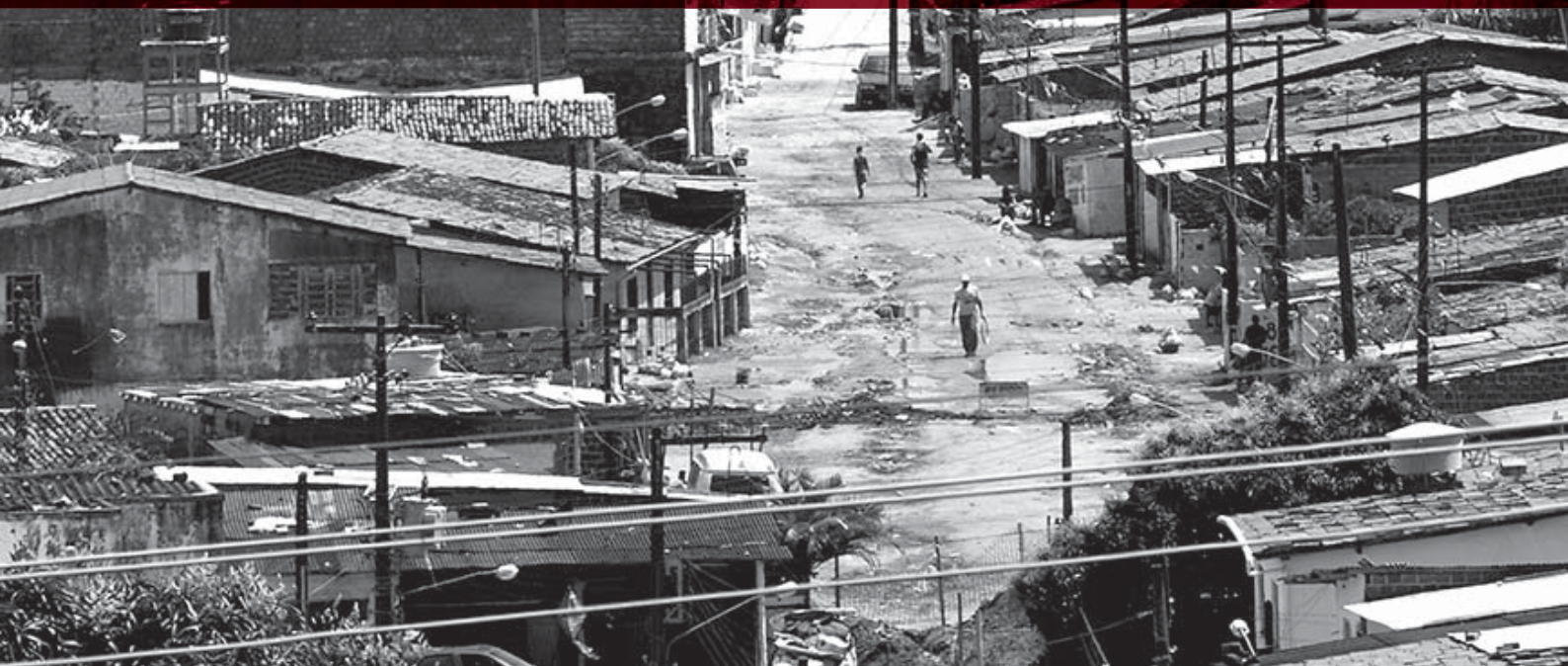
CAF DEVELOPMENT BANK OF LATIN AMERICA

2017 RED Report on Economic Development

Urban growth and access to opportunities:
A challenge for Latin America



Urban growth and access to opportunities:
A challenge for Latin America

CAF DEVELOPMENT BANK OF LATIN AMERICA

2017 RED Report on Economic Development

Title:
Urban growth and access to opportunities:
A challenge for Latin America

ISSN: 980-6810-01-5

Editor: CAF
publicaciones@caf.com

Graphic design: Estudio Bilder / Buenos Aires.

Printed in: Panamericana Formas e Impresos S.A.
acting only as a printer
Bogota, Colombia - January 2018

The digital version of this book
can be found at: scioteca.caf.com

FOREWORD

Cities are the main driver of the development of nations. They harbor productive processes of greater complexity and value added, and offer more economic opportunities. This explains the fast increases in urbanization rates, first in countries where the Industrial Revolution occurred, and then in the rest of the world. Indeed, migration to cities from the rural sector happens, in most cases, by pursuing the opportunities for progress that can be found in cities. Latin America is not an exception.

Cities facilitate the economic and social interactions of families and firms, improving the matching between complex jobs and skilled labor, between input suppliers and productive processes, and between people who share the same interests and tastes. Cities also facilitate the dissemination of ideas and knowledge, promoting learning and innovation.

But cities also harbor processes that, from time to time, overshadow their achievements. Walking through any of the great Latin American capitals, one can see that wealth and opportunities coexist with traffic congestion, environmental deterioration, poverty and inequality. It is unclear why the balance in some cities is tilted more to one side or the other. This report is a contribution to understanding this phenomenon and offers conceptual elements that can help overcome it through public policy interventions.

In this sense, this report shifts from the traditional debate on whether cities should be more or less compact, and emphasizes, instead, the concept of accessibility, which is understood as a city's ability to create a wide range of opportunities as well as the conditions that allow for them to be harnessed.

This report argues that accessibility depends on four main areas of public policy: urban land use planning, the provision of infrastructure and the regulation of mobility, housing market flexibility, and the existence of coordination and governance mechanisms at the metropolitan level. These areas are closely interrelated, which is why urban policies should be conceived considering a comprehensive approach.

Land use planning and regulation, for example, provide the legal framework that determines the location of firms and households in the urban space, and, therefore, the distance between available jobs and potential workers. The effective distance, however, is determined not only by the physical distance but also by the possibilities to travel within the city, that is, the mobility infrastructure, the coverage and quality of public transportation, and the incentives for using private vehicles.

Accessibility also depends on the availability of decent and affordable housing, which is achieved by increasing the flexibility of the housing supply and creating conditions that favor demand, especially among the poorest families. This can be achieved, for example, through targeted subsidies or access to mortgage loans. Finally, metropolitan governance bodies facilitate the coordination of land use, mobility and housing policies, in contexts where the economic and social interactions that unfold in a city exceed its administrative boundaries.

Through this new edition of the Report on Economic Development (RED), CAF seeks to build an urban development agenda that, based on rigorous evidence, provides public policy proposals to improve accessibility in the cities of Latin America and, therefore, the wellbeing of their inhabitants.

Luis Carranza Ugarte
CAF's Executive President

ACKNOWLEDGMENTS

The Department of Economic Analysis and Knowledge for Development, led by Pablo Sanguinetti, is in charge of developing CAF's annual flagship report (Report on Economic Development, RED). Academic coordination of the RED 2017 was led by Pablo Sanguinetti and Juan Vargas. Gilles Duranton was the academic advisor.

The authors of the chapters are the following:

Chapter 1 Juan Vargas

Chapter 2 Cynthia Goytia and Pablo Sanguinetti

Chapter 3 Fernando Álvarez and Ricardo Estrada

Chapter 4 Pablo Brassiolo and Gustavo Fajardo

Chapter 5 Christian Daude

Alejandra Abrodos was in charge of content editing. Agustina Hatrick and Cynthia Marchioni were responsible for the copyediting. Translanguage was in charge of the translation to English.

The chapters benefited from research papers specifically prepared for this publication by Prottoy A. Akbar, Guillermo Alves, María Laura Alzúa, Julián Amendolaggine, María Laura Arrosa, Laura Atuesta, Irlys Barreiro, Alejandro Betancourt, María Elena Botero Ospina, Gustavo Canavire-Bacarreza, Juan Carlos Duque, Guillermo Cruces, Guadalupe Dorna, Juan Carlos Duque, Gilles Duranton, Juan Miguel Gallego, Néstor Gandelman, Miquel-Ángel García-López, Nicolás Garrido, Pablo Gluzmann, Josbelk González, Cynthia Goytia, Catrihel Greppi, Miguel Lacabana, Eduardo Lora, Sergio Alberto Montoya, Ana I. Moreno-Monroy, Nicolás Navarrete, Pablo Navarrete, Neave O'Clery, Jorge Eduardo Patino, Carlos Eduardo Sepúlveda, Joaquin A. Urrego and Miguel Vargas.

The authors are grateful for the valuable comments they received from Fernando Álvarez de Celis, Andrés Antillano, Lucila Berniell, Carolina Camacho, Tomás de la Barra, Dolores de la Mata, Guillermo Díaz, Nicolás Estupiñán, Chico Ferreira, Yessy Garay, Edward Glaeser, Carolina Gutiérrez, Paola Hidalgo, Jorge Kogan, Pablo López, Daniel Ortega, Angie Palacios, Luisa Parra, Lenin Parreno, Nicole Perelmuter, Diego Puga, Roberto Quercia, Daniel Rodríguez, Paul Romer, Martín Rossi, Esteban Rossi-Hansberg, Hernán Ruffo, Ana María Sanjuan, Ernesto Schargrodsky and Manuel Toledo.

The research assistants were Jonathan Cohen, Roberto Ferrer, Matías Italia, Juan Sebastián Ivars, Agustina Hatrick, Federico Juncosa, Cynthia Marchioni and Diego Martín. The authors especially appreciate the collaboration of Rafael Ch in the creation of CAF's Database on the Extension of Metropolitan Areas (BEAM by its acronym in Spanish) and in other technical aspects of the report.

INDEX

Chapter 1
Urbanization without development? 17

Chapter 2
There is room for growth: Land use and urban structure 69

GRAPH INDEX

TABLE INDEX

TEXT BOX INDEX

URBANIZATION WITHOUT DEVELOPMENT?

Chapter 1

Chapter 1
URBANIZATION WITHOUT DEVELOPMENT?[1]

Introduction

In his book Toward a Theory of Economic Growth, published in 1968, Simon Kuznets argued that the process of economic growth usually involves structural changes, of which urbanization is the most important one. Twenty years later, in Cities and Economic Development, Paul Bairoch points out that, before the Industrial Revolution, only the civilizations that managed to generate agricultural surpluses and to create transportation networks for their commerce, which is to say the most developed ones, became urbanized. These seminal works document how urbanization has been closely interrelated with economic development, and how both phenomena mutually reinforce each other in a kind of virtuous circle. In fact, for many social scientists, urbanization is the hallmark of economic development. For example, in the absence of historical information on per capita income, several authors have used Bairoch's estimates of historical urbanization rates as a measure of economic prosperity.[2]

The relationship between economic development and urbanization can partly be explained by a country's industrialization. Technological change manifests itself through an increase in agricultural productivity and the large-scale production of goods and services in cities, among other factors. These processes free up labor from the rural sector and attract it to the cities. Also, by reducing the distance between people and firms (by improving the matching between good jobs and skilled labor) and by facilitating access to suppliers, inputs and markets for produced goods, cities generate increases in productivity and in wages beyond those that are attributable to industrialization. Furthermore, physical proximity also favors the dissemination of ideas and talent, which brings forth new cycles of innovation and technological change.

In this way, cities, as nuclei of the urbanization process, can become the drivers of economic growth and productivity. For example, at the end of the last decade, the 600 economically largest cities in the world produced more than half of the global gross domestic product (GDP), with less than a quarter of the world's population.[3] In 2010, the 289 cities in Latin America with more than 200,000 inhabitants produced more than three quarters of the region's GDP, with only half the population (MGI, 2012).

1. This chapter was written by Juan Vargas, with research assistance from Rafael Ch and Diego Martín.
2. For example, Acemoglu et al. (2002) and Dittmar (2011).
3. The 100 largest cities produced almost 40% of world GDP (MGI, 2011).

Accessibility is a fundamental measure of wellbeing in cities, and refers to the ability to take advantage of the opportunities offered by the city.

However, the growth of cities can also increase commuting times, levels of pollution, housing prices and crime rates, among other phenomena. Furthermore, by attracting low-income rural households that migrate in search of better opportunities, cities also make poverty and inequality more visible. In fact, both in present day and in the 19th century developing countries, the growth of cities is associated with the creation of informal settlements and poverty belts with limited access to public services and precarious property rights. The United Nations Human Settlements Program (UN-Habitat) estimates that between 1995 and 2014 the world's population living in these conditions grew by more than 200 million people, reaching 880 million people. Everything seems to indicate that this number will continue to increase in the coming decades.

Even if the economic benefits of urbanization are partially overshadowed by poverty and inequality to a greater or lesser extent depending on the context, urbanization is an unstoppable process: nowadays, about 54% of the world's population lives in urban areas and between 2010 and 2015 this figure increased by 2 percentage points per year. If the annual urbanization rate were to follow this same path in the future, two-thirds of the world's population will live in cities in just over a decade. UN-Habitat estimates that the number of people living in cities will double by 2050.

In this regard, the cities' ability to increase productivity, wealth and wellbeing in greater proportions than traffic, pollution, crime, informality and poverty, crucially depends on public policies and the way in which they manage to take advantage of the economic benefits of urbanization while reducing their social costs through adequate regulation and the provision of transport infrastructure and basic services. This challenge is particularly important in Latin America, as it is the second most urbanized region in the world after North America, surpassing even European urbanization levels.[4] Latin America also has the fastest growing urban population since 1950: it went from an urbanization rate of 41% in 1950 to 80% in 2015.[5]

The 2017 Report on Economic Development (RED 2017) is an effort to understand the most critical challenges that the cities of Latin America are facing for their development. To this end, the concept of accessibility is highlighted as a fundamental measure of wellbeing in cities. Accessibility refers to the ability of households and firms to take advantage of the opportunities that the city offers. For families, the opportunities to obtain well-paid jobs, to have quality housing and to enjoy urban services and amenities. For firms, the opportunity to access inputs and skilled labor, and easily reach more consumers. Thus, accessibility depends both on a city's ability to generate jobs and attract and train qualified workers, as well as on

4. In this report, the term North America encompasses the United States and Canada, while Mexico is included in Latin America.

5. Roberts et al. (2017) argue that this figure is inflated by the particular definition of urban population used by statistical offices in the countries of the region. The authors show that by applying a comparable measure at the regional level, the rate of urbanization in Latin America barely exceeds 70%.

the firms' and households' locations in the urban territory, and their ability to mobilize within the city.

The key determinants of urban accessibility are, therefore, land use regulation (which determines where firms and families are located in the city), transport supply and infrastructure (which determines how people and goods mobilize within the city), and the housing market (which determines the quality of housing, as well as its availability and price). These three elements define the structure of RED 2017: Chapter 2 looks at aspects of urban density and land use regulation, Chapter 3 analyzes mobility in cities, and Chapter 4 examines the housing market. The report closes with an additional chapter that underlines the importance of relying on metropolitan governance schemes for the coordination of urban development policies whose challenges often exceed the administrative boundaries of cities.

Even though the determinants of accessibility are examined separately in each chapter, they are not independent of each other. The regulation of land use, for example, supports the development of one or more business centers, and therefore affects the size and density of the city; the mobility infrastructure is correlated with the location and size of households; and the rigidities of the housing market influence the formation of informal settlements and, consequently, the urban structure. The interdependence of these aspects is discussed in depth in Chapter 2.

Focusing on the concept of accessibility draws attention away from the debate on whether cities should be compact or can continue to grow in size. In fact, urban accessibility is not necessarily linked to any specific urban structure and can be achieved in different city types, with varying levels of population concentration and employment.

In addition to this introduction, this chapter includes four other sections. In "Patterns of long-term urbanization", stylized facts are established which suggest that, despite accelerated urbanization in recent decades, Latin America has not experienced a development which is consistent with its urbanization trajectory. The "Conceptual framework" emphasizes the importance of urban accessibility as a measure of wellbeing. The fourth section offers additional diagnoses, comparing some characteristics of Latin American cities with those of cities in other regions of the world. Finally, the fifth section summarizes the report's main messages.

Long-term urbanization patterns

In Europe, and shortly after in the United States, urbanization was followed by the development of the manufacturing sector in cities, which was facilitated first by the increase in agricultural productivity, and later, in the middle of the nineteenth century, by the Industrial Revolution (see figure to the left of panel A in Graph 1.1, p. 23). The existence of agricultural surpluses in pre-industrial

Informality in cities can be seen in labor informality, in the informality of transport and in housing informality.

Europe freed up rural labor that moved to other predominantly urban sectors. Likewise, the Industrial Revolution attracted rural labor to cities, both in Europe and later in the United States. These two factors determine the urbanization dynamics that respond to productive incentives.

In these regions, the average annual increase in the urbanization rate was almost 2% between 1800 and 1850, and almost 2.5% over the next five decades (see figure on the left of panel B in Graph 1.1). Hence, these are regions with productive cities, industrial and financial sectors with high value added, and high wages.

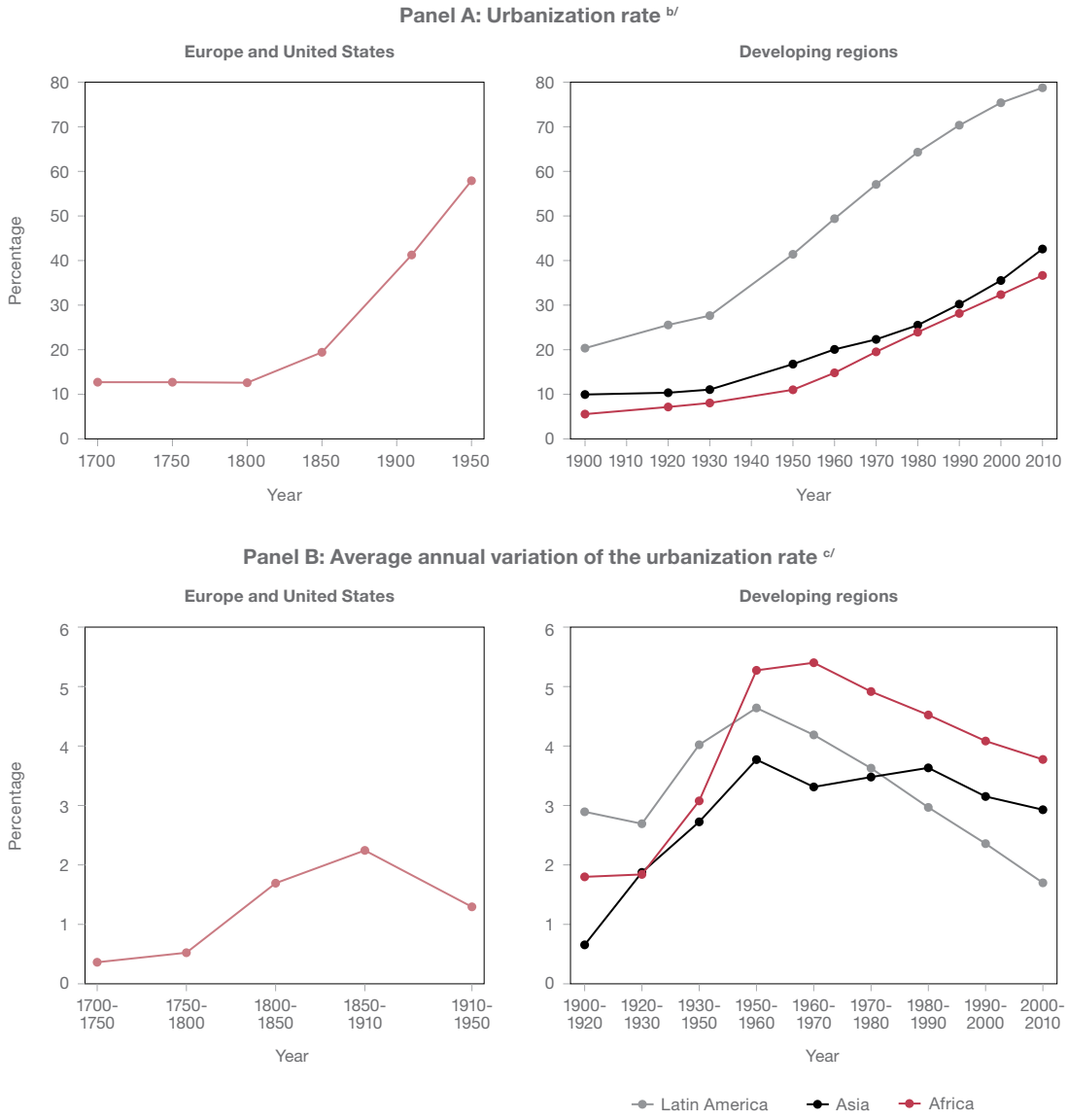
In contrast, in developing countries (with some exceptions, such as the Southern Cone of Latin America), urbanization did not appear in parallel with or as a result of the Industrial Revolution. This occurred later, at the end of the first half of the twentieth century, in response to the increase in prices of natural resources (whose income was substantially used in non-tradable urban goods and services with low value added) and to improvements in health, which led to a drop in the mortality rate and an increase in natural population growth (see figure on the right of panel A in Graph 1.1).

Furthermore, in recent history, many developing countries have adopted policies that either directly or indirectly reinforced urbanization processes, but also produced economic distortions that undermined their ability to increase productivity and generate income. Examples include the introduction of burdensome taxes on the production or export of agricultural goods, highly protectionist policies that produced less innovative industries with markets concentrated in large cities, the assignment of public jobs and transfers (in urban locations, but not very productive) as political rewards. Meanwhile, in Latin America, the rural sector's high poverty rate, which is often associated with exploitation by landed elites, is also a factor leading to low productivity urbanization and the expansion of urban informality.

Informality in cities is one of the most important transversal themes of this book. It can be seen in labor informality, but also in the informality of transport and housing (see Chapters 3 and 4). The incidence and growth of informal settlements in Latin America is one of the most pressing public policy issues in the region. Unfortunately, as will be evident throughout the book, there is very little information available to study this phenomenon in a rigorous way.[6]

6. Some exceptions are to be found in the informal settlement maps that the Techo Foundation has produced in some cities in the region (Techo, 2016), particularly in Buenos Aires and Bogota, and the work of Duque et al. (2016), who use satellite images of the physical characteristics of the urban fabric together with *machine learning* algorithms, to predict the incidence of informal settlements in some cities of Latin America.

Graph 1.1 Urbanization rates in developed and developing regions [a/]



a/ Europe only includes Western Europe. Developing regions are Africa, Latin America and Asia.
b/ The Graph shows the urbanization rates of the United States and Europe for the period 1700-1950, and those of selected developing regions for the period 1900-2010.
c/ The Graph shows the average annual variation of the urbanization rate, divided into 50-year periods for the United States and Europe, and into decades for developing regions.

Source: Author's elaboration based on Jedwab and Vollrath (2015).

After its late start, urbanization in Latin America, and generally in the developing regions, occurred much more rapidly than in developed countries. In the middle of last century, the average annual growth rate of the urban population in Latin

America was almost 5%, although at present it has fallen as low as 2%, which is lower than the average rates of Asia (3%) and Africa (4%, see figure on the right of panel B in Graph 1.1, p. 23). In fact, most of the growth in global urbanization rates since the mid-twentieth century is due to the urbanization of developing countries.

As a reflection of their lagging urbanization, which is chaotic and guided by reasons other than the development of the manufacturing sector and high value-added services, most cities in developing countries show low average wages and high levels of poverty and inequality.

Urbanization without development

Graph 1.2 presents evidence in favor of the Kuznets and Bairoch hypothesis: urbanization levels have a close positive relationship with per capita income. This is true at any point in time when comparing different countries, as well as within a same country over time. For example, panel A of Graph 1.2, which focuses on the relationship between urbanization and per capita income in 1870, shows that, on average, the most urbanized countries in the second half of the nineteenth century also showed higher levels of development. At that time, the countries of Latin America enjoyed relatively low levels of urbanization, considering their degree of development, except for the countries of the Southern Cone, which then boasted a level of development comparable to that of European nations.[7] The slope of the regression line for this period suggests that if GDP per capita had multiplied by two, the urbanization rate would have increased by an average of 14 percentage points.

In 2010 (see panel B of Graph 1.2), Latin American countries, without distinction between the Southern Cone and the rest of the region, had a relatively low level of income, considering their high degree of urbanization.[8] The relationship between urbanization and per capita income is extremely stable over time. In 2010, 140 years after the period analyzed in the figure on the left of Graph 1.2, multiplying GDP per capita by 2 would have increased the urbanization rate by 13 percentage points.

More generally, Graph 1.2 suggests that, in the second half of the nineteenth century, urbanization rates in Latin America, the United States, and European nations were between 0% and 50%, and this heterogeneity was reflected in per capita incomes ranging from USD 440 to USD 3,190 (constant 1990 prices). In 2010, urbanization rates for the same group of countries converged at levels between 49% and 95%, but per capita income ranged from USD 1,100 to USD 30,500. In other words, a century and a half after the Industrial Revolution, Latin America experienced a relative convergence with the developed world in

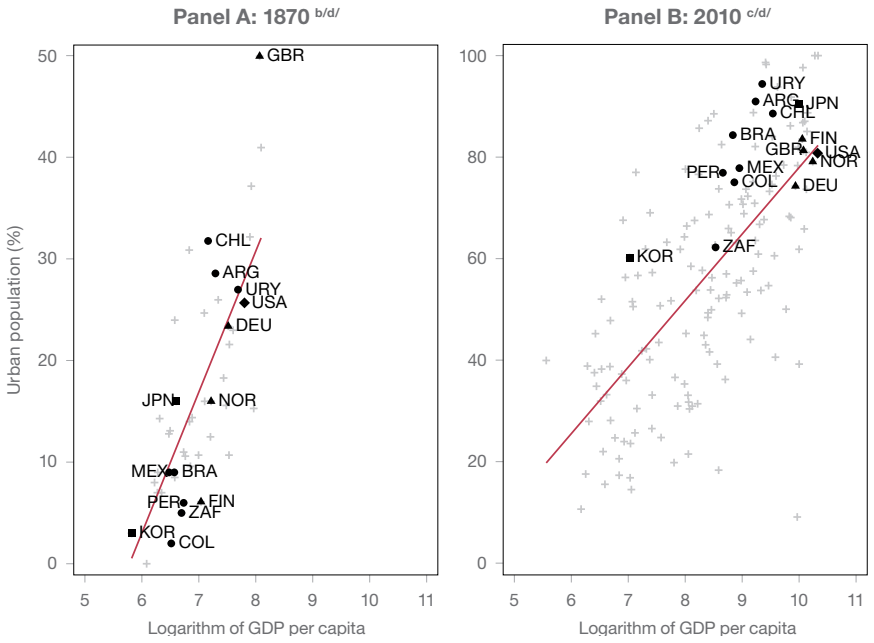
7. This is evident in panel A of Graph 1.2 because the countries of Latin America (except those of the Southern Cone) are located at the bottom of the cloud of dots, below the regression line, which represents the average relationship between the rate of urbanization and the level of per capita income.

8. In panel B of Graph 1.2, the countries of Latin America are located at the top of the cloud of dots, above the regression line.

terms of urbanization, but not in terms of income. On the contrary, the income gap multiplied by 4. This is what the literature has called "urbanization without development".[9]

Considering its level of urbanization, Latin America lags in terms of per capita income, compared to developed countries.

Graph 1.2 Relationship between urban population and the logarithm of per capita gross domestic product in 1870 and 2010 [a/]



a/ The graph shows the regression by ordinary least squares between the urban population measured in percentage and the logarithm of per capita gross domestic product (GDP) at constant prices of 1990.
b/ In 1870 the sample contains 46 counries.
c/ In 2010 information is shown for 159 countries.
d/ Some countries are included for reference: Germany (DEU), Argentina (ARG), Brazil (BRA), Chile (CHL), Colombia (COL), South Korea (KOR), the United States (USA), Finland (FIN), Great Britain (GBR), Japan (JPN), Mexico (MEX), Norway (NOR), Peru (PER), South Africa (ZAF), and Uruguay (URY).

Source: Author's elaboration based on Jedwab et al. (2017).

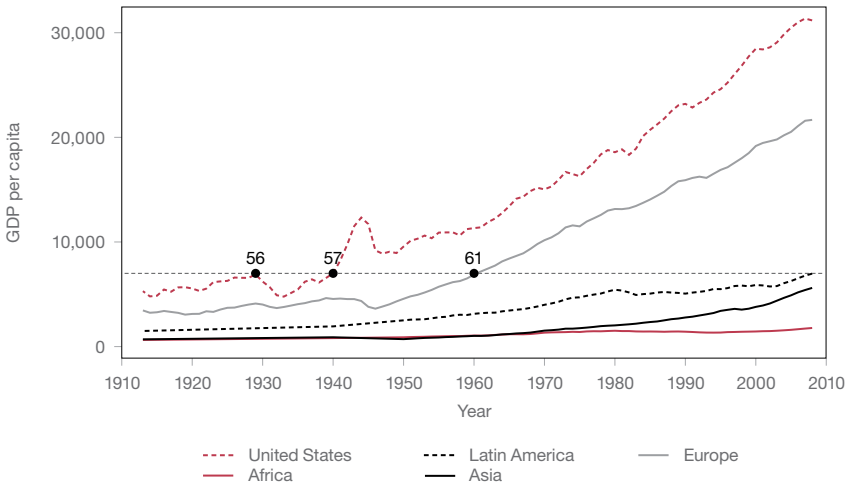
This evidence suggests that, given its level of urbanization, Latin America lags in terms of per capita income compared to developed countries.[10] Empirically, it is possible to calculate this gap. It is a simple hypothetical calculation that asks what the current level of income would be in Latin America if its development had followed the process of urbanization in the same way that it did in the United States or Europe.

9. See Jedwab and Vollrath (2015) for a summary of this literature.

10. This lag is not particular to Latin America, and is generally observed in most developing countries.

Graph 1.3 Real GDP per capita and urbanization rate by region for the period 1913-2008

Panel A: Evolution of GDP per capita between 1913 and 2008 [a/]



Panel B: Urbanization rate in 1913 and 2008 [b/]

	Urbanization rate (%)	
	1913	**2008**
United States	46	81
Europe	35	73
Latin America	21	78
Africa	12	42
Asia	12	58

a/ Panel A shows the real GDP per capita in US dollars at constant prices of 1990 for several regions. The dotted line shows the real GDP per capita of Latin America in 2008 in US dollars at constant prices of 1990 (USD7,000). The dotts above the dotted line show the urbanization rate of the United States (56% and 57%) and Europe (61%) when they had that level of real GDP per capita. The data for GDP per capita belong to Roser (2017).
b/ Panel B shows the urbanization rate in 1913 and 2008 which is constructed using the country sample of Jedwab et al. (2017).

Source: Author's elaboration based on data by Jedwab et al. (2017) and Roser (2017).

Graph 1.3 shows the evolution of per capita income in the United States and Europe, compared to that of Latin America (and Asia and Africa) over a period of almost 100 years, between 1913 and 2008. The dotted line projects GDP per capita in Latin America at the end of the last decade, throughout the study period. The intersections between this projection and the lines that show the evolution of GDP per capita in the United States and Europe, mark the years in which these two regions reached the current average income of Latin America: 1929 and 1940 in the case of the United States (before and after the Great Depression), and 1960 in

the case of Europe. US and European urbanization rates for that income level were 57% and 61%, respectively, about 20 percentage points less urbanization than the current Latin American rate of 78%.

That is to say, today Latin America has a level of urbanization similar to that of developed countries (81% in the United States and 73% in Europe), but it lags half a century in relation to Europe and 70 years in relation to the United States in terms of per capita income levels. As already noted, despite closing urbanization gaps among regions of the world, income gaps have increased. This explains why the positive relationship between urbanization and wealth is less strong in developing countries, including Latin America, than in developed countries.

In summary, even though urbanization has accompanied the development process of countries throughout history, Latin America, like other developing regions, currently has a low level of development, considering its high rates of urbanization. This is because the region has not taken advantage of all the potential benefits of urbanization, but has suffered many of its costs. The benefits and costs of urbanization are presented, from a conceptual standpoint, in the following section.

Conceptual framework

This section presents a broad conceptual framework that supports and motivates the structure of RED 2017. The fundamental question in the field of economics called urban and regional economics is: what determines the location of economic agents (people and firms) in space? This question is the starting point of the conceptual framework, and has to do with the choice of households and businesses regarding where to locate in the larger context (in the countryside or in the city, and in which city), but also with their choice of where to settle in the local context (in what part of the city). Although these are two interdependent choices, for explanatory reasons they are presented separately. This chapter studies the aggregate choice and, thus, the determining factors of urbanization and the size of cities. The distribution of people and firms within the city and, by extension, the urban structure, is discussed in detail in Chapter 2.

In this regard, the definition of a city is fundamental in the development of our conceptual framework. The simplest definition is based on administrative boundaries: a city is a municipality or district that exceeds a certain population threshold and enjoys a certain degree of administrative autonomy.[11] However, this is not the most relevant definition of a city for the study of the location choices of economic agents. Conceptually, a city is the spatial integration of economic and social activity. Firms are located near other firms and households to have better access to production inputs, workforce and consumers. Households are located

11. The population threshold is necessary to distinguish the city from small settlements or villages. Administrative autonomy may vary depending on the degree of centralism or federalism of the country, and the level of political integration with surrounding metropolitan areas.

Benefits in terms of the city's productivity and wellbeing depend on the balance between the agglomeration gains and the congestion costs.

near other households and businesses to exchange ideas and knowledge and have better employment opportunities.

Two features of this definition of a city are worth highlighting. The first is that economic activity is independent of administrative boundaries. The second is that the very existence of a city assumes that agglomeration (of households and firms) brings benefits, but also costs. Indeed, the benefits in terms of the city's productivity and wellbeing depend on the balance between the gains of agglomeration and the costs of congestion.[12] Proximity between people facilitates the exchange of goods, services, ideas and knowledge, but also makes land more expensive, facilitates the transmission of bacteria, leads to the accumulation of waste and brings robbers closer to their potential victims.

Agglomeration gains, congestion costs and amenities

Agglomeration gains imply that as the size of the city increases, so does its productivity and, therefore, the average wages (see Text box 1.1). According to Duranton and Puga (2004), this occurs via three basic mechanisms. First, agglomeration allows agents to share indivisible assets. These are assets that cannot be separated into smaller parts in order to distribute their consumption. For example, football stadiums can only exist if there are enough fans to cover their huge fixed costs (those of the construction of the stadium). If each of the 95,000 spectators of the Maracana (Rio de Janeiro, Brazil) lived in a self-sufficient plot, scattered across the huge Brazilian territory, it would not be possible to build the stadium and, what's more, football would not even exist.[13] This "tragedy" can only be avoided because cities agglomerate football fans. Other indivisible assets that would not exist if cities did not concentrate a large number of potential users that justify their construction and maintenance have to do with the transport infrastructure (such as airports, terminals and ports) and that of a few basic services such as water and sewage networks, as well as highly complex hospitals. Many of these indivisible assets increase the wellbeing of households and the productivity of firms.

The second mechanism linking agglomeration to productivity has to do with the fact that agglomeration improves the quantity and quality of matchings that are profitable, both individually and for society as a whole: matches between firms and better suppliers of specialized inputs, or between companies and better workers (more educated or with highly specific productive), matches between potential investors for funding projects, and matches between friends who share interests.

12. The pioneering work in urban economics that proposes to conceptualize cities according to this balance is that of Henderson (1974).

13. The existence of football teams would not be possible without agglomeration.

The third mechanism is that agglomeration facilitates the production, dissemination and exchange of ideas and knowledge, which allows both greater innovation and a greater accumulation of human capital, and consequently, an increase in the city's productivity. For Glaeser (2011), this is the main factor for what he calls the "triumph of the city": learning does not tend to flourish on its own and requires interaction between individuals and exchanges of ideas.

The available evidence shows that these three mechanisms effectively give rise to agglomeration gains that can be quantified empirically and which translate into higher wages in larger cities, as described in Text box 1.1 for the case of Colombia.[14]

While agglomeration gains increase with city size, the more populated and dense cities also face, with greater intensity, various problems associated with a high concentration of families and businesses in space. These include rising prices of urban land for housing, industrial and business uses, increased vehicular traffic, environmental pollution and high crime rates.[15] The conjunction of these phenomena is what the literature has called congestion costs.[16]

Text box 1.1 Agglomeration economies in Colombian cities

Graph 1 shows the relationship between population and average wages in 13 main Colombian cities for 2001 and 2014. The positive slope of the regression line suggests that in both periods the larger cities had higher average wages, which is consistent with agglomeration economies. Bogota, for example, is the Colombian city with the highest productivity and the largest population in both years. In 2005 prices, the Colombian capital went from having a monthly average wage of USD 349 (adjusted for purchasing power) and 6,400,000 inhabitants in 2001, to enjoying an average monthly wage of USD 835 with 7,800,000 inhabitants in 2014. But there are also relative movements between cities throughout this period. Such is the case of the city of Bucaramanga, which advanced from fifth place among the most productive cities in 2001, to the second place in 2014, according to its average wage.

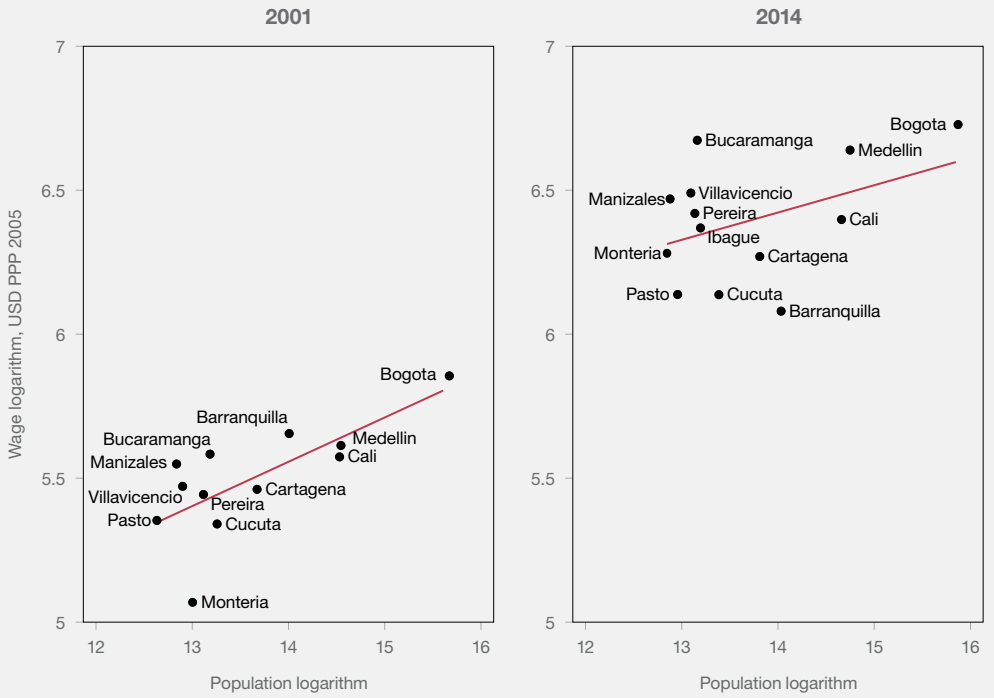
According to this information, wage elasticity among the urban population in Colombia is 0.15 in 2001 and 0.09 in 2014. These magnitudes, which are within the range of other estimates presented by international specialized literature for developing countries, suggest that a 10% increase in the urban population of Colombia is related to increases in the average wage of 1.5% (in 2001) and 0.9% (in 2014).

14. Rosenthal and Strange (2004) provide a comprehensive review of empirical evidence on the existence of urban agglomeration economies.

15. Glaeser and Sacerdote (1999) argue that urbanization facilitates criminal activity because criminals can access a greater density of potential victims.

16. The positive relationship between the size of the city and the cost of congestion has been documented by Henderson (2002) and Timmins (2006).

Graph 1 Agglomeration economies in Colombia: Population and average wages for major cities in 2001 and 2014 a/ b/ c/



a/ The graph shows the regression by ordinary least squares with robust errors. The dependent variable is the wage logarithm (USD PPP at constant 2005 prices). The independent variable is the population logarithm.
b/ The sample includes 12 cities in 2001. In 2014 the city of Ibagué is added to the analysis.
c/ Wage elasticity (USD PPP at constant 2005 prices) relative to the population is 0.15 for 2001 and 0.09 for 2014. This means that a 10% increase in the population increases the average salary by 1.5% in 2001 and by 0.9% in 2014.

Source: Author's elaboration using data from household surveys in Colombia (DANE, 2001 and 2014).

Agglomeration gains and congestion costs coexist in the city, and the most prosperous cities are those that manage to address this balance by trying to minimize the negative effects of congestion. The aforementioned fact that urbanization in Latin America is driven partly by factors other than the genuine processes of industrialization and innovation (such as relative price distortions or urban-based clientelistic policies), may justify that several cities in the region find themselves in a bad “balance”, where congestion costs are high compared to the agglomeration gains.

But cities are more than a relative balance between agglomeration gains and congestion costs. Cities also offer recreation and entertainment amenities, with public spaces such as parks and basic social services such as education. These can be highly relevant when choosing a place of residence, to the extent that they can compensate for lower relative wages or higher congestion costs. More specifically,

amenities can be categorized into three types: i) public space amenities (such as parks, waterfronts and pedestrian zones), ii) cultural amenities (such as cinemas, theaters and entertainment venues), and iii) environmental amenities (such as ecological reserves or bodies of water).[17] These amenities, which are difficult to find in rural areas or relatively small urban settlements, increase the wellbeing of people who can access them.[18] Football stadiums, concert halls, cinemas, historical centers, parks, among others, are spaces that allow the enjoyment of diverse activities and are often the hallmarks that make people want to visit or live in certain cities.

Households choose to live in cities that offer the best combination of wages, size, quality, and price of housing, and amenities.

Agglomeration gains, congestion costs and the amenities that characterize a city are therefore the conceptual elements that help to understand the number and size of cities in a country (see Text box 1.2). They are also factors that influence the location decisions within a city.[19] On average, larger cities offer higher wages, although their size is also directly proportional to congestion costs.

The size distribution of a country's cities follows an economic process in which every individual weighs the advantages and disadvantages of migrating from the countryside to the city, and living in one city or another (Henderson, 1974). Households choose to live in cities that offer the best combination of wages, size, quality and price of housing, and amenities they can enjoy (Oates 1981; Tiebout, 1956). For example, smaller cities are expected to compensate for their lower wages with lower congestion costs (such as cheaper housing) and / or better amenities. Otherwise, lower-wage cities may implode due to the growth of intermediate or large cities (Rosen, 1979; Roback, 1982).

Text box 1.2 A simple model that explains the determinants of the size of cities

The proposed conceptual framework, which accounts for the determinants of the system of cities and their size, can be formalized in a simple way. According to Duranton (2008), a city can be understood using the four curves (representing simple mathematical relations) that are illustrated in Graph 1. First, the wage curve (panel A) shows the positive relationship between the size of a city, measured by its population (N), and the average wage (w). This positive relationship shows that larger cities are more productive, which underlies the concept of agglomeration economies discussed above.

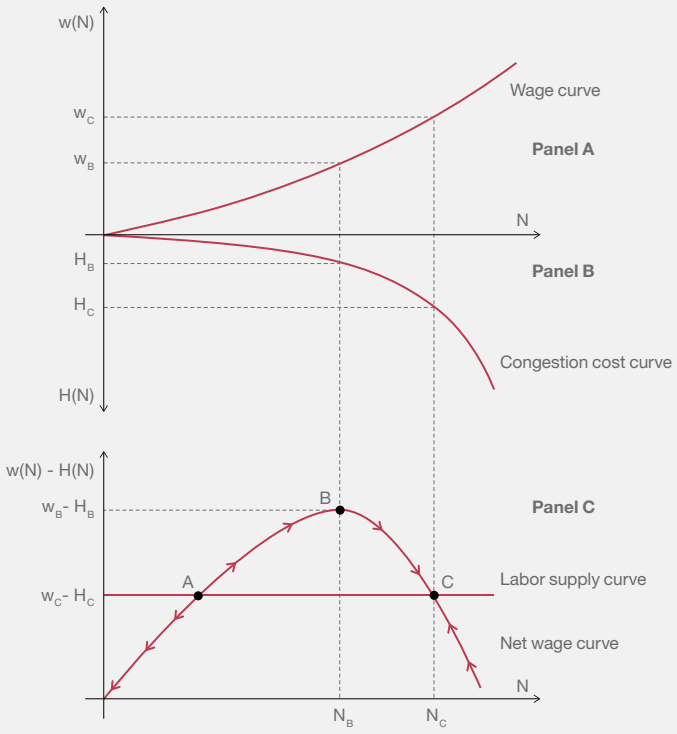
17. The number and diversity of restaurants and bars constitute another type of amenity which could be called "consumption amenities" and are not included in this typology. In fact, some cultural amenities, such as theaters, also belong to this category.

18. Using all the available waves from the CAF Survey (described in the last section of this chapter), Arrosa and Gandelman (2016) find that the access to amenities increases the quality of life of Latin Americans.

19. This is discussed in further detail in Chapter 2.

Second, the congestion cost curve (panel B) shows the positive relationship between city size and congestion costs (H). As city size increases, congestion costs increase (which in addition to costs associated with vehicular traffic include the costs of accessing housing, pollution, and exposure to crime, among others), because it is more difficult to move around, more expensive to find places to live, etc.

Graph 1 Forces that determine the size of a city



Source: Duranton (2008).

Third, the net wage curve (panel C) shows the difference between wages and congestion costs. If for low population levels, increases in the size of the city generate moderate rises in congestion costs, the net wage curve grows with the population level. However, above a certain size (N_B in Graph 1), space and infrastructure limitations make congestion a constraint, and therefore costs increase much more than productivity and wages as the city grows. This causes net wages to grow with size, but only to a certain extent (N_B), beyond which the costs of congestion are responsible for a decrease in the relationship, resulting in an inverted "U" shape.

Fourth, the labor supply curve (panel C) represents the net wage that workers demand, and reflects their reserve utility (what they could achieve if they migrated to another city within the system of cities, or to the countryside if the relevant migration is rural-urban).[a] By making the city more attractive for each wage level, more and better amenities will move the labor supply curve downward, as workers are willing to make up for lower wages with better amenities.

The equilibrium of the model determines the size of the city (in the absence of regulations or other interventions). This is defined by the intersection between the net wage curve and the labor supply curve, and represents the situation in which workers obtain the net wage required to remain in the city. The intersection marked by point A does not constitute a stable equilibrium because, starting from this point, if the population decreases, net wages fall below the levels required by workers, which causes them to migrate outside the city to the point where it disappears. Also, an increase of the population raises net wages, which generates migratory flows towards the city. These flows stop once point C is reached, which marks the other intersection and, therefore, the other equilibrium (which is stable). The equilibrium size of the city (in terms of population) is given by the point N_C and, as a result, wages and the level of equilibrium congestion costs are determined by w_C and H_C respectively.

The equilibrium size of the city N_C is not its optimal size in terms of wellbeing. The optimum is marked by the point N_B, where the net wage is maximized. This implies that the equilibrium of the system of cities leads to fewer and larger cities than what is considered optimal. This occurs due to coordination failures. Although the founding of new cities, whose population inflow would reduce the size of existing ones, is beneficial to all, no one would make the individual decision to fund a new city by themselves. If this were to happen, due to its tiny size, this hypothetical city would be extremely unproductive, there would be no agglomeration gains and wages would be almost nil. Therefore, to create new cities (and to limit the size of existing ones), it is necessary for a sufficiently large group of workers and firms to work together. However, this coordination is impossible because every individual will prefer to wait for others to take the risk of the initiative.

This simple model allows us to understand the size distribution of cities in diverse contexts. Cities with different wage levels (due to different degrees of specialization and the sizes of agglomeration economies), and with different levels of congestion, will have different net wage curves and, consequently, different sizes. In the extreme, very productive cities with low congestion costs and many amenities will tend to be very large, at the expense of other cities and the size of the rural sector.[b]

The model also allows to study the effects of changes in internal factors (agglomeration gains, congestion costs and amenities) and external factors (such as aggregate economic growth and better living conditions in other cities and in the countryside), as well as of specific policy interventions, on the size of cities. First, it can be assumed that a technological innovation will lead to an increase in the size of agglomeration economies in the city, which moves the wage curve upwards but keeps the congestion curve constant. This would generate an upward shift of the net wage curve, placing the new equilibrium to the right of N_C, and the size of the city would increase. Something similar would happen through the implementation of a congestion tax to reduce the circulation of private cars. In this case, the cost of congestion would fall by keeping the wage curve

constant, so that the congestion cost curve would shift upwards and the city would grow. Second, the effect of increases in city amenities has already been explained for the labor supply curve: more amenities shift this curve downwards because people will be willing to migrate to a city with more amenities even if they are paid less; consequently, the city grows. Third, an improvement in the living conditions of other cities, or the living conditions of the countryside, increases the wellbeing of people outside the city and, therefore, shifts the labor supply curve upwards. Thus, the city's equilibrium size decreases.

a. The labor supply curve is flat if workers are perfectly mobile between cities, or between the countryside and the city.
b. The size of cities and in particular the existence of excessively large megacities also depends on (bad) public policies, generally populist ones,that generate distortions in the distribution of the size of cities. This is the case of "urban biased" policies, such as the mass generation of public employment in a city, with political objectives (see Glaeser, 2014).

Room for urban development policies

This conceptual framework has at least two important implications for the design of public policies. First, agglomeration gains are an example of what economists call positive externalities*:* in their localization choices, households and firms do not consider that their agglomeration will generate social benefits by improving the productivity of other firms and the wages of other individuals. Agents would then agglomerate less than would be socially desirable. Likewise, congestion costs exemplify negative externalities: individuals do not consider the social damage caused by their actions when generating congestion and, therefore, there is more congestion than is socially optimal*.*

Externalities are market failures that can be solved by designing specific policies to counteract them. That is to say, the very existence of cities implies a broad space for the design of public policies whose general objective must be to take better advantage of agglomeration gains and reduce the costs of congestion. In this sense, the aim of public policies should be to improve urban accessibility. This refers to the number and quality of attainable opportunities for an individual or a firm in the city space. For example, the possibility for families to obtain jobs and for firms to hire skilled labor and obtain inputs, the availability of education and health services, and the presence of amenities, among other things. Thus, accessibility depends both on a city's ability to generate jobs, services and amenities, and on the location of homes and firms *vis-à-vis* a transport infrastructure that will allow them to mobilize at a reasonable cost. This way, regardless of the physical sprawl of a city or its metropolitan area, improvements in access reduce the "real distances" within the city and, therefore, increase agglomeration economies with its subsequent improvements in productivity and wellbeing.

The second implication of this conceptual framework is that, by changing the balance between agglomeration gains and congestion costs (at a given level of amenities), public policy generates incentives for households to migrate towards cities with higher wages and lower congestion. In other words, better cities attract

more inhabitants and, paradoxically, public policy cannot improve cities and limit their growth simultaneously. This will be one of the book's most important cross-cutting arguments.

Better cities attract more inhabitants and, paradoxically, public policy cannot improve cities and limit their growth simultaneously.

From this point of view, urban poverty and the informality associated with the growth of cities are not fundamentally bad, as long as they respond to transient processes. Prosperous cities attract people, many of whom are poor, but it is generally not true that cities impoverish people. Thus, the flow of poor individuals into cities should be interpreted as a strength, not a weakness. In other words, urban poverty must be compared to rural poverty, not to urban wealth (Glaeser, 2011). This does not imply, however, that public policy is not compelled to create the conditions to improve the situation of the city's most vulnerable sectors (see Chapter 4). As noted above, this is achieved by strengthening accessibility (to formal jobs, decent housing, quality education and health, etc.).

Once the objective of public policies (increasing accessibility in cities) has been identified, it is important to ask how this objective can be achieved. To this effect, it is essential to understand the public policy dimensions that affect accessibility. As mentioned in the introduction, it critically depends on three complementary areas: the regulation of land use and city structure (discussed in Chapter 2), mobility and transport (discussed in Chapter 3), and the formal and informal housing markets (the characteristics of which are discussed in Chapter 4). Another crucial aspect is the need to coordinate public policies in these three dimensions throughout the city's area of influence, which generally exceeds its administrative boundaries. Chapter 5 reviews different forms of metropolitan governance which can help achieve the goal of accessibility to a greater or lesser extent.

Diagnosis: The urbanization of Latin America in comparative perspective

Empirical measurement of city

The conceptual framework states that it is not appropriate to define the geographical scope of a city by its administrative limits. Conceptually, the city covers the entire physical space where interactions between economic and social agents occur. However, this concept must be translated into a standard measurement that can be replicated across geographies with different socioeconomic and institutional features. This will allow a comparison between the urban characteristics of Latin America and those from other regions of the world.

In this regard, there is a debate around what should be considered part of the urban span of a city. First, there are functional definitions that can be classified into two main types: those that use the coverage spans of

networks (such as utility networks or transport systems), and those that use travel patterns, which define metropolitan areas as integrated labor markets. These definitions are not without problems. For example, large city areas in developing countries are often occupied by slums without access to networks. Moreover, it is difficult to obtain georeferenced and comparable information on network coverage or the daily travel patterns of the workforce. Second, there are measurements based on the identification and classification of adjacent built-up areas. Lastly, as Duranton (2015) points out, there are non-economic criteria for determining the extension of a city, which include feelings of belonging *vis-à-vis* a common characteristic, such as love for the local football team. Naturally, the use of mixed definitions is commonplace.[20]

Taking advantage of high-definition satellite images, which are openly available and provide comparable global information at a low cost, RED 2017 proposes an operationalization of the conceptual definition of a city or urban agglomeration. Specifically, CAF's Database on the Extension of Metropolitan Areas (BEAM by its acronym in Spanish) measures the presence and expansion of cities (and their metropolitan area) as a cluster of stable nighttime luminosity pixels, captured through satellite imagery for 2000 and 2010 (Ch et al., 2017).[21] [22]

The theoretical basis for this approach can be found in two branches of specialized literature. On the one hand, remote monitoring literature, which shows that nighttime luminosity is a reliable indicator of urban extension.[23] On the other, economic literature, which points out that nighttime luminosity is a strong predictorof national and subnational economic activity, which is directly related to the conceptual definition of a city in this report.[24]

---

20. To access a more in-depth analysis of the different methodologies for calculating the extension of the urban area see Duranton (2015), and for more details on mixed measurements based on thresholds of contiguous population density and on transit times see Roberts et al. (2017). For their part, O'Clery and Lora (2016) propose a definition based on the commuting times of workers, and operationalize it for the Colombian context.

21. Due to discrepancies between satellites that capture information for the same year, to abnormal fluctuations, blurriness and geographic misalignments, different cleaning processes, intercalibration and filters were implemented to ensure the quality and comparability of satellite images. Ch et al. (2017) explain the technical details of the measurement proposed by BEAM, as well as its scope and limitations.

22. BEAM is not the first attempt at estimating the urban extension using satellite images of nighttime luminosity. Salvatore et al. (2005) establish an estimate based on the same source of information. However, there are three fundamental differences between these two pursuits: i) unlike Salvatore et al. (2005), BEAM follows the methodology proposed by Wu et al. (2013) to ensure compatibility between images captured by satellites of different ages (and therefore different levels of lens accuracy); ii) using the methodology of Abrahams et al. (2017), BEAM corrects the blurring luminosity pixels so as not to overestimate the urban extension (according to the authors this overestimation can reach up to 60% of the actual urban area), while Salvatore et al. (2005) does not make this correction, meaning it must establish an arbitrary minimum threshold of luminosity to classify a pixel as urban in order to avoid estimating urban areas as being too large; iii) unlike BEAM, Salvatore et al. (2005) considers a minimum threshold of population density.

23. See Eva et al. (2004); Huang et al. (2016); Elvidge et al. (2007, 2009); Zhang and Seto (2011); Liu et al. (2012); Wu et al. (2013), and Hsu et al. (2015).

24. See Henderson et al. (2012); Bleakley and Lin (2012); Storeygard (2016); Michalopoulos and Papaioannou (2013); Lowe (2014) and Weidmann and Schutte (2016).

The proposed measurement poses several benefits in terms of precision and empirical practicality with respect to alternative approaches. First, it allows comparisons between regions of the world with different socioeconomic and institutional characteristics, and thus different administrative definitions of a city. Second, it does not need to make assumptions about people's mobility and does not require data on travel or network coverage. Third, although it requires a minimum amount of stability for the light pixels (which excludes interurban roads in non-urbanized areas, for example), the measurement does not assume arbitrary thresholds of population density, travel time and quantity. Moreover, by only considering contiguous pixels and focusing on populations of more than 100,000 inhabitants, the measurement neglects natural phenomena that generate nighttime luminosity (such as fires). Fourth, although the required computational demand is not low, it is far from that of other methods that are based, for example, on construction coverage measurements, and ensures the identification of urban areas without the need for administrative or census information. Finally, luminosity as a measure of economic activity makes the clear identification of integrated labor markets possible, which makes this methodology consistent with the conceptual definition of a city.

Luminosity as a measure of economic activity allows us to clearly identify integrated labor markets, which is consistent with the conceptual definition of a city.

As mentioned before, there are measurements that allow estimates of the urban extension, based on daytime images taken by satellites such as Landsat, by identifying contiguous built areas, green areas, and bodies of water (Goldblatt et al., 2016 [see Chapter 2]).[25] This is, perhaps, a more accurate method for measuring the extension of cities. However, in practical terms, the differences between this type of measurement and that used in RED 2017 do not seem to be very significant, and, when available, complementary evidence from other sources (such as Google Earth) suggests that measurements based on nighttime luminosity are more in line with the reality of the cities in question (see Text box 1.3).

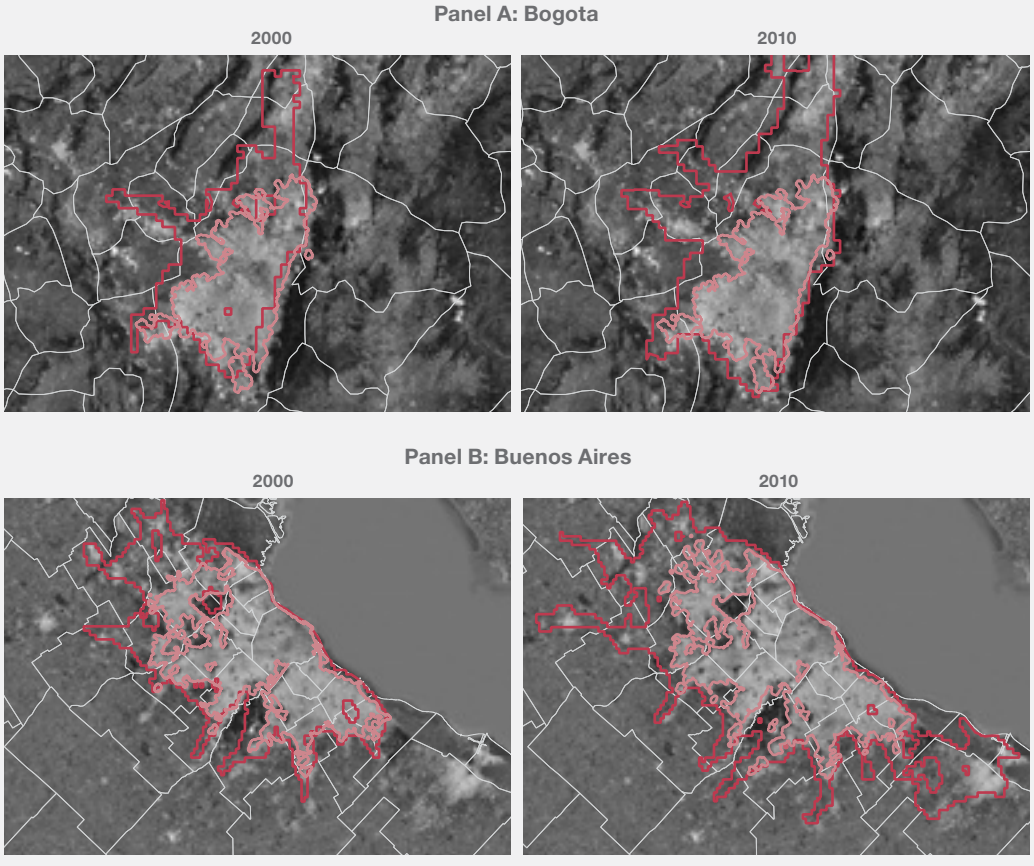
Text box 1.3 Validating the city measurement

How does BEAM's city size estimate compare with other measurements? Graph 1 shows the urban extension calculated by BEAM for Buenos Aires, Sao Paulo, Bogota and Mexico City in 2000 and 2010. In each of these two years the extension is compared with three different reference points: i) the administrative boundaries of the city and all the surrounding municipalities that make up its metropolitan area; ii) the extension estimate of the Atlas of Urban Expansion (AUE)[a]; and iii) satellite imagery from Google Earth.

25. This is the approach, for example, of the Atlas of Urban Expansion (AUE), jointly developed by UN-Habitat, the Lincoln Institute of Land Policy and New York University; and the European Commission's Global Human Settlement Layer (AUE, 2016).

In both 2000 and 2010, the BEAM estimate exceeds that of the AUE in most of the cities in Graph 1 (except for Sao Paulo in 2000). In fact, except for Mexico City, the growth of the urban footprint between 2000 and 2010 is almost imperceptible from the AUE perspective, but evident when using the methodology proposed for this report. In particular, the AUE does not seem to consider the formation of metropolitan areas as important as the merger between 2000 and 2010 of the urban area of Bogota and the municipality of Chia (north of the city), that of Buenos Aires and La Plata (to the southeast), and that of Sao Paulo and Campinas, Indaiatuba and Itu (to the northwest). Considering our proposed conceptual definition, these mergers make sense because, over time, these cities have expanded to the point of sharing markets with their neighbors. For example, many workers in Bogotá live in Chia and travel to Bogota daily. The same happens with workers from Buenos Aires who live in La Plata. Furthermore, the Google Earth images show that in all cases there is indeed a continuum of urban infrastructure that resembles in its geographical coverage the extension estimated by BEAM.

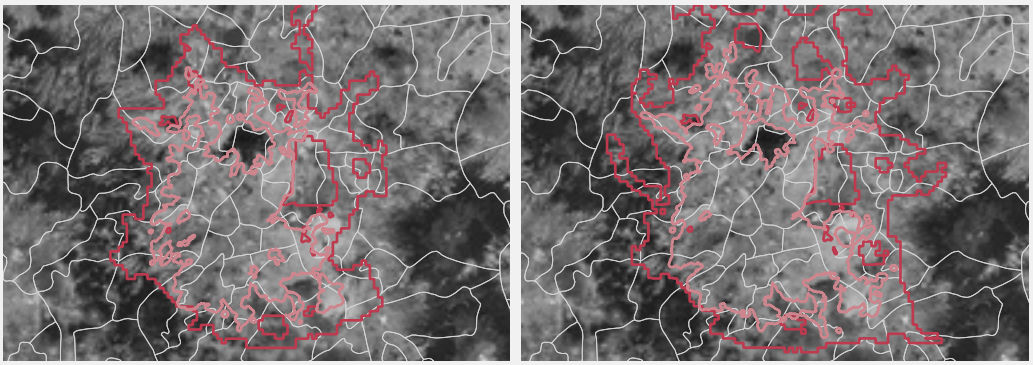
Graph 1 Urban extension in 2000 and 2010 according to BEAM, the AUE, Google Earth and the administrative boundaries in selected cities of Latin America [a/ b/]



Continued ›

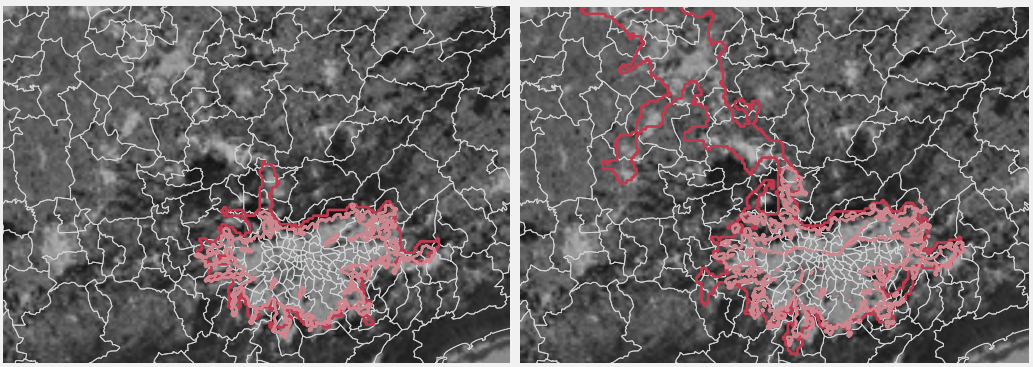
Panel C: Mexico City

2000 2010



Panel D: Sao Paulo

2000 2010



a/ The underlying image is from Google Earth and shows the extension of the built area and the rural area for each year. The dark red perimeter delimits the area of urban extension estimated by BEAM, and the light red, the area estimated by the AUE. The white limits are those of the smaller administrative area according to each country

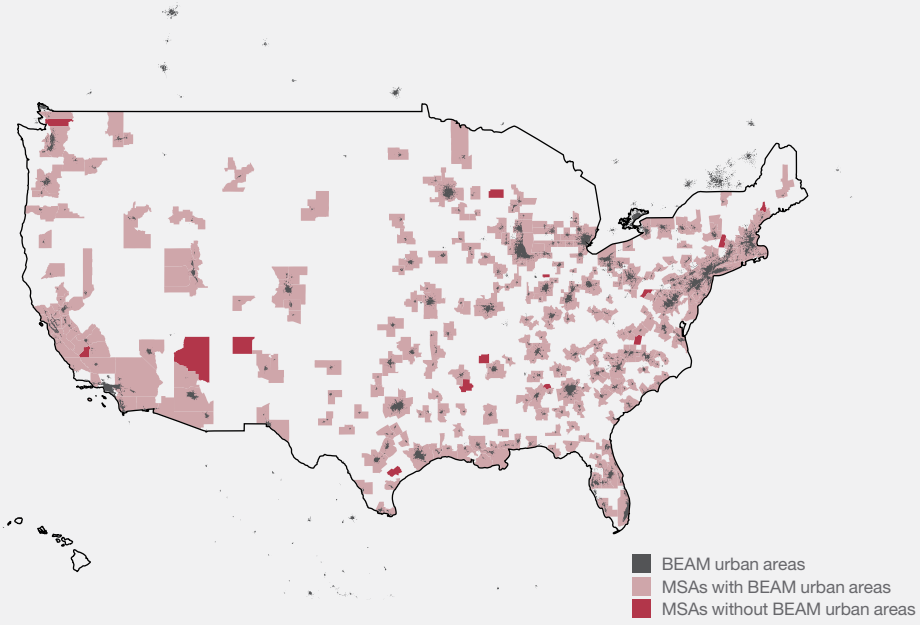
Source: Author's elaboration using data from Google Earth (2017), AUE (Angel et al., 2016a), BEAM (CAF, 2016), Ch et al. (2017) and DIVA-GIS (2017).

Beyond these concrete examples, it is possible to make a systematic comparison between all cities with information from AUE.[b] According to Graph 1, the extension estimated by BEAM is greater than that of the AUE in most cases. However, an analysis that compares the structure of cities according to their size indicates that the two distributions are practically the same, both in the aggregate and by region. That is, the largest cities according to BEAM are also the largest for the AUE, the second places also coincide, and so on. Furthermore, as discussed above, contrast with Google Earth images suggests that the methodology proposed in this report can identify contiguous urban fabric not detected (or not included for unclear reasons) by the AUE.

Finally, an additional validation test consists of comparing the metropolitan areas estimated by BEAM with those measured by country-specific censuses. The United States Office of Management and Budget identifies metropolitan statistical areas (MSAs) or geographical

regions with high population density and close economic relationships throughout the established area (USCB, 2010). Although these are not legally constituted areas or administrative divisions as such (nor are they areas whose geographical form follows observed construction or population settlement patterns), MSAs establish the presence of important population centers, which are used for statistical purposes in the United States. If we consider the 325 MSAs with more than 100,000 inhabitants in 2000 and contrast them with the 191 urban areas identified by BEAM that same year, we find a coincidence level of 94% (see Graph 2).[c] The 6% discrepancy is explained, for the most part, by the existence of MSAs in which none of the cities that comprise them have a population greater than 100,000 inhabitants, the detection threshold established by BEAM.

Graph 2 Comparison between the urban areas of BEAM and the MSAs in the United Sates for 2000 [a/]



a/ A metropolitan statistical area (MSA) is a geographic region with high population density and a population nucleus with economic links to the surrounding region.

Source: Author's elaboration using data from BEAM (CAF, 2016), Ch et al. (2017), and the United States Population Census 2000 (USCB, 2010).

a. The AUE measures the extension of cities by combining various sources of information. These include images from the Landsat satellite and Google Earth, census data from urban areas, and specific surveys obtained from local researchers measuring different land uses, property regimes, affordability of housing and attributes of properties available for sale or rent, in cities covered by the AUE.
b. Perhaps because of its computational complexity, the AUE database only includes a sample of 200 cities worldwide, 26 of which are in Latin America. Chapter 2 describes this database in more detail and uses it to study aspects of land use and urban structure.
c. The number of metropolitan areas identified by BEAM in 2000 (191) is lower than the number of MSAs with more than 100,000 inhabitants in that same year (325) because in several instances the metropolitan areas estimated with the proposed methodology for this report cover more than one MSA. For example, the BEAM extension estimate for Los Angeles intersects three MSAs, and Chicago includes two MSAs.

Latin America in comparative perspective

The BEAM database allows us to study some characteristics of Latin American cities in comparison to those of other regions.

Based on the information provided by BEAM (a measurement contribution carried out especially for RED 2017), some characteristics of Latin American cities or metropolitan areas can be studied in comparison to those of developed regions such as the United States and Western Europe, and to those of other regions of the world.[26] Specifically, the analysis includes Asia and Africa. While the first region has undergone an accelerated development process in recent decades, per capita income levels in the latter have been practically stagnant since the early 20th century (see panel A of Graph 1.3, p. 26).

Table 1.1 shows the estimated number of cities in each of the considered regions, in both 2000 and 2010. Except for Western Europe, the estimated number of cities is increasing in all regions.[27] The highest growth occurs in Southeast Asia (where the number of cities almost triples), followed by sub-Saharan Africa (where it more than doubles), Latin America (increases by 55%), and North America (increases by 24%).

Table 1.1 Estimated number of metropolitan areas with more than 100,000 inhabitants, by region in 2000 and 2010

	2000				2010			
	1 metropolitan area	2 metropolitan areas	More than 2 metropolitan areas	Total	1 metropolitan area	2 metropolitan areas	More than 2 metropolitan areas	Total
Sub-Saharan Africa	58	0	1	**59**	121	4	1	**126**
North America	179	8	4	**191**	212	14	10	**236**
Latin America	204	3	0	**207**	309	7	4	**320**
Western Europe	270	12	2	**284**	245	16	12	**273**
Southeast Asia	52	1	0	**53**	137	3	2	**142**
Total				**794**				**1,097**

Source: Author's elaboration using data from BEAM (CAF, 2016) and Ch et al. (2017).

Based on these metropolitan areas, estimated for the two periods, a diagnosis can be made in terms of three variables that describe the structure of cities: physical span, population, and population density.[28]

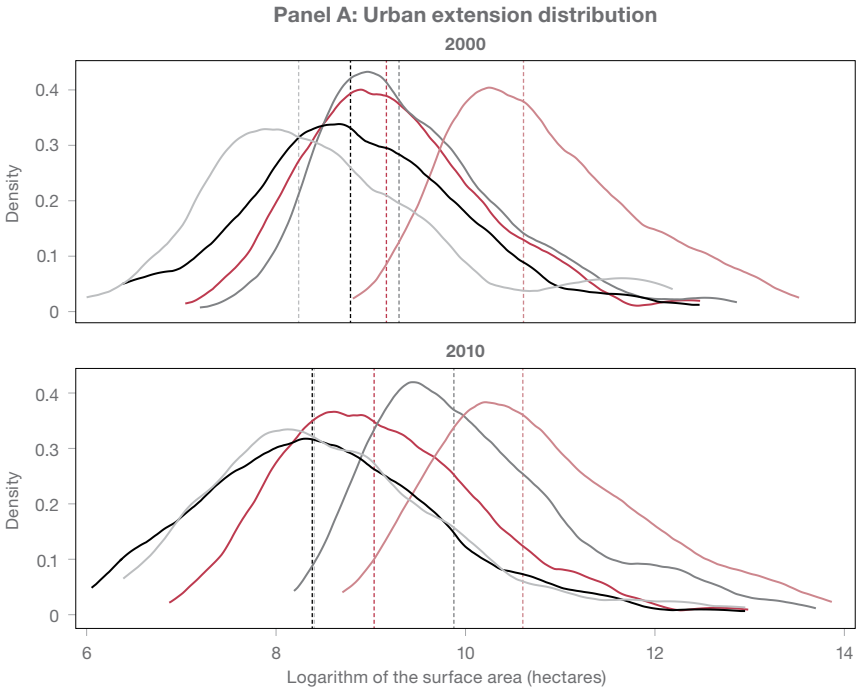
26. Since the methodology suggested in this report captures the cities' area of economic influence, in some cases the resulting cluster of light pixels corresponds to one city, and in others, to administratively larger areas called metropolitan areas. So as not to repeat "cities or metropolitan areas" throughout the chapter, when referring to BEAM, both terms are used alternately.

27. The estimated number of metropolitan areas decreases in Europe due to the merger (in terms of nighttime light-pixel clusters) of several cities. This happens mainly in the metropolitan area of London, in Belgium and Holland, in the Rhine area, and in northern Italy.

28. While this chapter uses BEAM to calculate the population density relative to the total area of the city (estimated from nighttime light-pixel clusters), Chapter 2 uses the AUE data to calculate the density relative to the constructed area, for the subset of cities in that sample.

Regarding the first dimension (see panel A of Graph 1.4), in 2000 the distribution of the physical size of Latin American cities is vaguely similar to that of Western Europe, with the latter slightly shifted to the right, indicating the presence of somewhat larger cities in Europe. Meanwhile, the size distribution of North American cities is located far to the right of the first two regions. In fact, the average physical size of cities in the United States and Canada in 2000 was 770 km^2, almost 4 times that of Western Europe (209 km^2), and almost 5 times that of Latin America (158 km^2).[29] On the other hand, the size distributions of cities in Southeast Asia and sub-Saharan Africa are shifted to the left relative to that of Latin America, although both distributions are less compact, with relatively long tails to the right that raise the average size to levels that are close to those of Latin America (141 km^2 in Asia and 133 km^2 in Africa).[30]

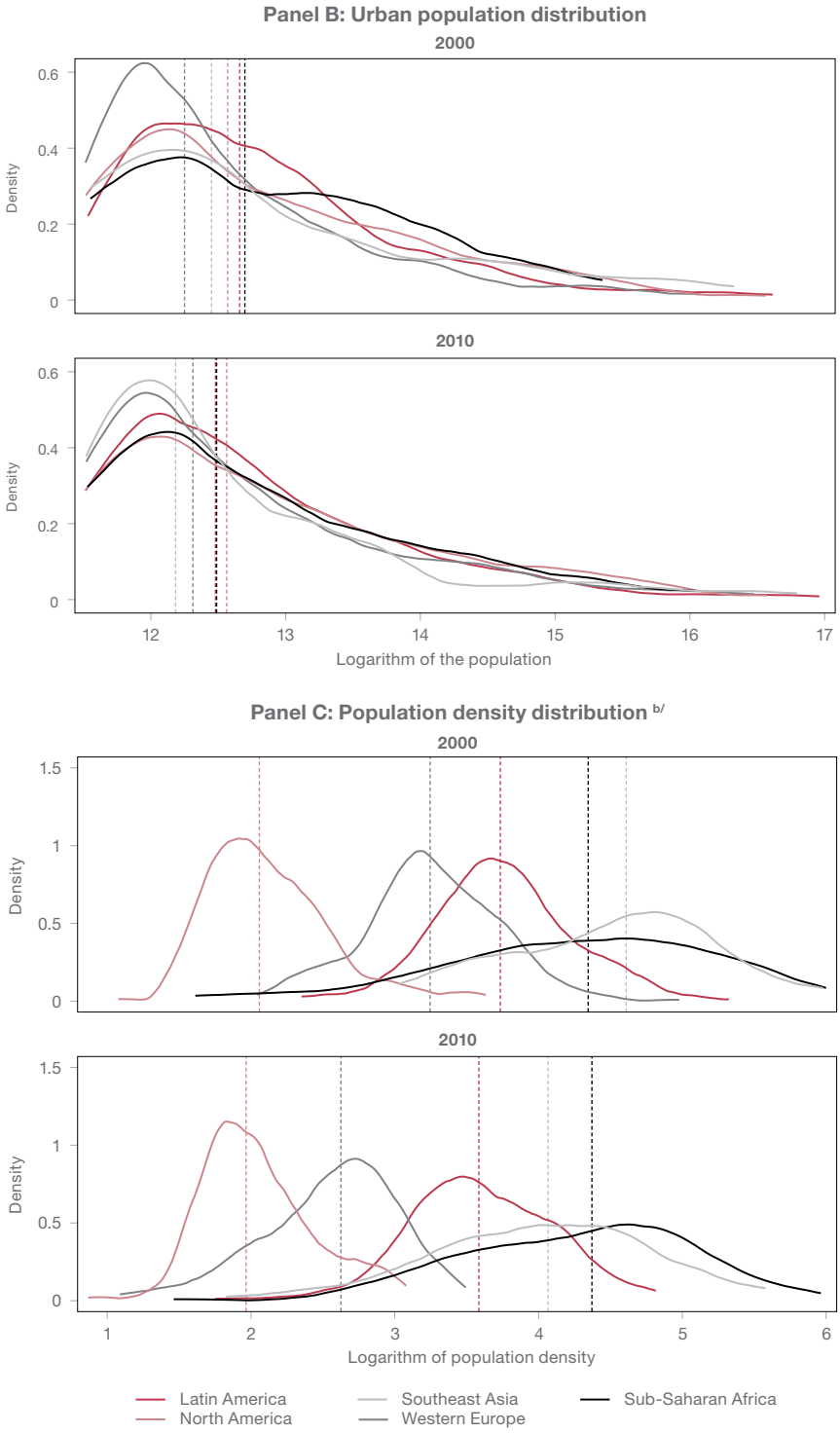
Graph 1.4 Comparison of the characteristics of Latin American cities with more than 100,000 inhabitants and those in other regions of the world in 2000 and 2010 [a/]



Continued ›

29. In 2000, half the cities in North America had more than 334 km^2, compared to 83 km^2 in Western Europe and 72 km^2 in Latin America.

30. One fact that accounts for the enormous heterogeneity between regions is that the size of the smallest city in North America is larger than the average size of cities in Southeast Asia (see panel A of Graph 1.4).



a/ The dotted lines show the median of each distribution.
b/ Population density is measured as the number of people per hectare.

Source: Author's elaboration using data from BEAM (CAF, 2016) and Ch et al. (2017).

Ten years later, all size distributions shift to the right, except for Africa which changes very little. The most dramatic transformation occurs in Western Europe, with average sprawls 2.5 times greater than in 2000 (532 km^2) which, therefore, close the gap with North America (whose average increases by 27%, to 976 km^2) steering away from Latin America (195 km^2), representing an increase of just over 20%). The changes in sprawl that occurred in the previous decade are due, mainly, to the growth of the urban area itself. However, it could also be that two (or more) previously disjointed metropolitan areas expand to the point of merging into a single metropolitan area. Table 1.1 (see p. 41) shows the instances in which this happens for each region. This implies that the observed growth of the average urban sprawl in all regions responds not only to suburbanization dynamics, but also to the economic merger of cities. In Europe, the number of metropolitan areas resulting from the union of two or more metropolitan areas with more than 100,000 inhabitants doubled between 2000 and 2010, from 14 to 28.

As for the second dimension, once the physical sprawl of the cities has been estimated, georeferenced population estimates available from secondary sources can be superimposed to calculate the size of the cities in terms of population.[31] Panel B of Graph 1.4 (see p. 43) shows the population distributions of the metropolitan areas, estimated for each region in 2000 and 2010. In 2000, population distributions do not differ substantially between regions, except for Western Europe, where the average population in cities with more than 100,000 inhabitants is almost 560,000, less than those of sub-Saharan Africa (around 700,000 inhabitants), Latin America (close to 820,000 inhabitants), North America (with almost 870,000 inhabitants) and Southeast Asia (about 1,160,000 inhabitants). The existence of a higher proportion of medium to small cities in Europe was partially reversed in 2010, when the European population distribution is closer to that of other regions, and the average population in cities with more than 100,000 inhabitants in Europe increased to around 730,000 inhabitants, similar to that of sub-Saharan Africa (with almost 760,000 inhabitants) and Latin America (close to 800,000 inhabitants). As discussed earlier, this is partly due to the merging of several metropolitan areas with more than 100,000 inhabitants between 2000 and 2010. On the other hand, it is interesting to note that the average population decreases slightly in Latin America and more significantly in Southeast Asia (where it reaches approximately 880,000 inhabitants, a drop of 30%).

In the five regions studied and over the study-period, size distributions of cities by population exhibit a long tail to the right of the distribution. This suggests that in every region there are few cities with large populations, or megacities. This phenomenon, which the literature has called urban primacy (e.g. Henderson [2002]), will be studied later in this section. In 2010, the largest metropolitan areas in terms of population in Latin America are Sao Paulo (more than 23

31. Ch et al. (2017) provide a detailed explanation of the various sources of population information and the specific methodology used to link these data with those of nighttime light pixel clusters. Intuitively, the total population of a metropolitan area is estimated by overlapping the extension of a city, calculated using luminosity data, with a georeferenced population layer, using census dat

million inhabitants, including Campinas, Indaiatuba and Itu [see panel D of Graph 1 in Text box 1.3, p. 39]), Mexico City (almost 21 million inhabitants), and Buenos Aires (more than 14 million inhabitants, including La Plata [see panel B of Graph 1 in Text box 1.3, p. 38]).[32]

High levels of population density can help, but they can also hinder urban accessibility and, therefore, wellbeing.

The third dimension is population density (panel C of Graph 1.4, p. 43). In both 2000 and 2010, Latin America exhibits densities that are much higher than those of Western Europe and North America, but lower than those of sub-Saharan Africa and Southeast Asia. In all regions, density is reduced between 2000 and 2010, which reflects sprawl increases that are greater than those of the population.[33] While the drop in density within sub-Saharan Africa is almost imperceptible, that of Western Europe is important. This region went from having 31 inhabitants per hectare on average in 2000, to 14 inhabitants per hectare on average in 2010, a 55% drop. As suggested by the information provided in Table 1.1 (see p. 41), this decrease in density of European cities can be explained by the increase in the physical sprawl of the cities, which resulted mainly from the merging of metropolitan areas between 2000 and 2010.

Average population density in Latin America in 2010 (41 inhabitants per hectare) was three times that of Europe (14 inhabitants per hectare) and five times that of North America (8 inhabitants per hectare).[34] Interestingly, only 5% of Western European cities had a higher population density than the Latin American average.

According to the conceptual framework in the previous section, high levels of population density can help, but they can also hinder urban accessibility and, therefore, wellbeing. Higher densities are closely linked to greater opportunities for the exploitation of agglomeration economies, but also with higher levels of vehicular congestion, contagion of diseases, high housing prices, crime and pollution, among other negative externalities of the urbanization process.[35] The evidence presented in panel C of Graph 1.4 (see p. 43) certainly suggests some negative association between density and degree of development. This may have two complementary explanations. On the one hand, as described in Chapter 2, an increase in average income

32. The largest Western European metropolitan areas in 2010 are the area comprising Liverpool, Manchester, Sheffield and Birmingham, the London metropolitan area and Moscow (in conjunction with Zelenograd); in North America, Los Angeles, with its large area of influence, New York and Chicago; in Sub-Saharan Africa, Johannesburg (and Pretoria), Lagos and Kinshasa; in Southeast Asia, Jakarta (and surroundings), Greater Manila and Bangkok (with Laem Chabang and Pattaya).

33. Chapter 2 points to this same fact, stylized for population density relative to the constructed area, using the AEU database.

34. These absolute density values are low compared to other available estimates (such as those presented in Chapter 2 using the AUE). The differences are mainly due to the BEAM methodology capturing large metropolitan regions which combine two or more metropolitan areas that are identified by other methodologies, as well as extensive suburban areas. For this reason, this description highlights the ordinal comparisons between regions.

35. Glaeser (2014), however, argues that high densities are better for the environment, since suburban inhabitants consume more energy than those living near the center, which generates a negative externality for the planet by deteriorating the environment. For example, Glaeser reasons, while 86% of Americans, on average, drive to work, only 1 in 3 New Yorkers do so.

levels is related to decrease in urban density. This happens because, as households have more resources available, their demand for residential space increases and, therefore, cities grow in extension. On the other hand, due to reasons discussed in "Long-term urbanization patterns", the relatively high density levels in Latin America and other developing regions may reflect the recent, accelerated and informal, urbanization that these regions experienced in the mid-twentieth century. Indeed, much of the high density of developing cities can be explained by the presence of slums (Jedwab and Vollrath, 2017).

In summary, the greater population density in Latin American cities compared to cities in developed regions is the result of physically smaller cities, but of similar size in terms of population. In other words, it has to do with the lower incidence of suburbanization processes in the region, which have already occurred in developed countries. This is, however, the average situation in the region, which conceals a significant variation between countries with very different experiences, some more akin to North America and Western Europe, others more like sub-Saharan Africa. Thus, it is worth focusing on Latin America to compare the different experiences within the countries of the region in terms of urban sprawl, population and population density.

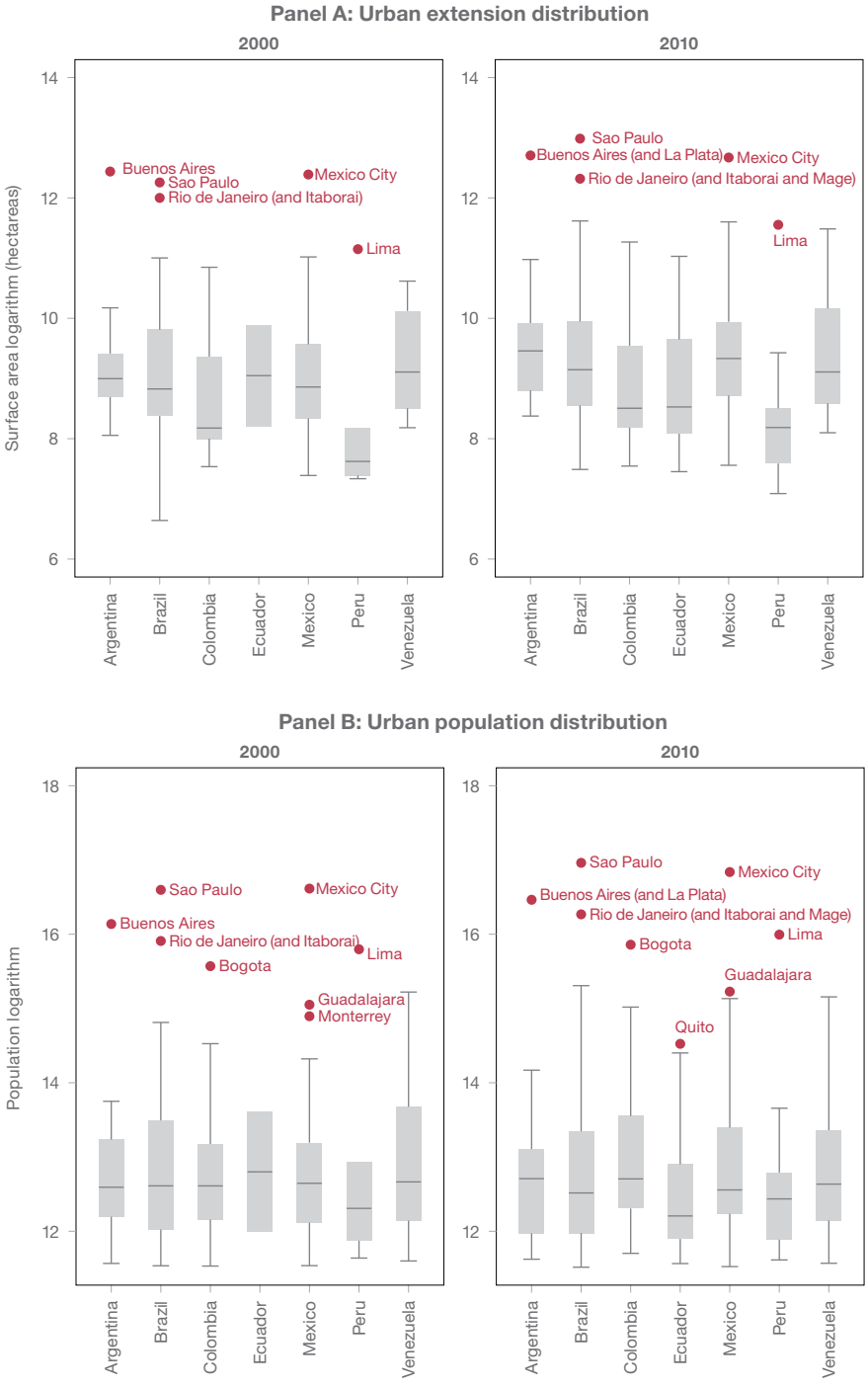
Sprawl, population and density in Latin America

The regional averages described in the previous subsection hide important intraregional variations, and even variations within the countries. In that sense, this subsection explores in more detail the distributions of physical size, population and density for cities with more than 100,000 inhabitants in some Latin American countries. These distributions are presented in Graph 1.5 (in panels A, B and C respectively, see p. 47 and 48).[36]

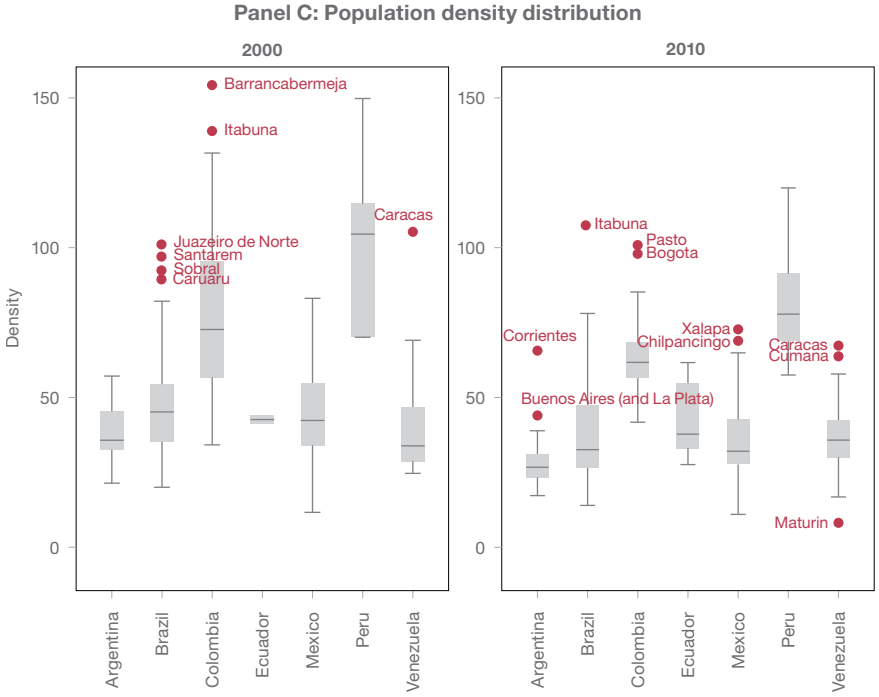
Regarding the physical size of the city, panel A of Graph 1.5 shows that in 2000 the smallest cities in terms of sprawl, on average, are in Colombia (87 km^2), while the largest are in Argentina, with an average sprawl 2.5 times greater than that of Colombian cities (222 km^2). In fact, while the average size of Argentine cities is similar to Western Europe (216 km^2), the average size of Colombian cities is even lower than that of sub-Saharan Africa (138 km^2).

36. The distribution of each variable for each of the analyzed countries is presented in a box-plot. It is a box with an inner horizontal line, outer vertical lines and, in some cases, external points to the vertical lines. The box is defined by the first and third quartiles of the represented distribution (25th and 75th percentiles); the inner line indicates the median and the outer lines the minimum and maximum values of the distribution, excluding atypical values (less than or greater than three standard deviations from the median). The latter are represented by points and in the specific case of Graph 1.5 the names of the cities that take these values are also included.

Graph 1.5 Comparison of the urban characteristics of Latin American countries for cities with more than 100,000 inhabitants in 2000 and 2010 [a/ b/ c/ d/]



Continued ›



a/ The graph shows the distribution of extension (panel A), population (panel B), and population density (panel C) for cities with more than 100,000 inhabitants in seven Latin American countries.
b/ The distribution of each variable in each country is reported by means of a box plot. The box is bound between the 25th percentile (bottom) and the 75th percentile (top). The horizontal line inside the box is the median (50th percentile). The outer horizontal lines represent the minimum and maximum values, without taking into account the outliers (more than three standard deviations above or below the mean). When occurring, these values are indicated by a dot and the name of the city is included.
c Calculations are made for cities with more than 100,000 inhabitants. For 2000 and 2010, 17 and 24 urban areas are used in Argentina, 59 and 88 in Brazil, 18 and 24 in Colombia, 2 and 11 in Ecuador, 42 and 59 in Mexico, 6 and 15 in Peru and, finally, 15 and 24 in Venezuela, respectively.
d/ Cities are metropolitan areas that have been estimated based on the continuity of night-light pixels. In Mexico, Puebla includes Tlaxcala, Apizaco and San Martín Texmelucan in 2010. In Brazil, Sao Paulo includes Campinas, Indaiatuba and Itu in 2010; Rio de Janeiro includes Itaboraí in 2000, and Itaboraí and Magé in 2010. In Argentina, Buenos Aires includes La Plata in 2010.

Source: Author's elaboration using data from BEAM (CAF, 2016) and Ch et al. (2017).

The largest size variability for cities with more than 100,000 inhabitants is observed in Brazil and the smallest in Peru (despite the large extension of Lima compared to other Peruvian cities). Ecuador and Venezuela do not present atypical values. The largest Latin American cities in 2000 are, in descending order, Mexico City (2,400 km^2), Buenos Aires (2,250 km^2) and Sao Paulo (2,100 km^2).

Ten years later, the average urban extension rose in almost every country in the region.[37] During the decade between 2000 and 2010, the largest percentage

37. The average decreased only slightly in Peru. However, the total extension area of all the cities with more than 100,000 inhabitants in the country almost doubled in this period. The fall of the average is due to the fact that in 2000 Peru had six cities with more than 100,000 inhabitants and in 2010 there were 15. If we consider urban expansion only in the nine original cities, Peru is the fastest growing country in the region.

High levels of population density can help, but they can also hinder urban accessibility and, therefore, wellbeing.

increase took place in Argentina and Colombia (35% in both cases). In absolute terms, however, the average physical sprawl of Colombian cities with more than 100,000 inhabitants in 2010 (118 km^2) is still among the lowest in the region and is well below the African average. Meanwhile, Argentina continues to be the country with the highest average urban physical sprawl in the region (300 km^2).

Due to the inclusion in BEAM of new cities that have exceeded the threshold of 100,000 inhabitants between 2000 and 2010, the size variance increases in all countries (except Brazil). Furthermore, the size of megacities in the region grows considerably. In 2010 the largest cities are, in descending order, Sao Paulo (4,360 km^2), Buenos Aires (3,300 km^2) and Mexico City (3,180 km^2).[38]

In terms of population distribution, panel B of Graph 1.5 (p. 47) shows that in 2000 the Latin American country with the least populated cities on average (among those with more than 100,000 inhabitants) is Ecuador (510,000 inhabitants). Meanwhile, the country with the largest averages in terms of city population is Peru (1,020,000 inhabitants). In fact, the dispersion of Latin America in 2000 closely resembles the dispersion among the regions analyzed in the previous section, with the Ecuadorian average similar to that of Western Europe (560,000 inhabitants), the region with the less populated cities, and the Peruvian average similar to that of the cities of Southeast Asia (1,160,000 inhabitants), the region with the most populated cities among those studied. The largest Latin American metropolitan areas in 2000 are, in descending order, Mexico City (16.4 million inhabitants), Sao Paulo (16.1 million inhabitants) and Buenos Aires (10.2 million inhabitants).

In 2010, mainly due to the appearance of new cities with more than 100,000 inhabitants, the average population drops in Ecuador, Mexico, Peru and Venezuela, and increases in Argentina, Brazil and Colombia. That year, the Latin American country with the least populated cities, on average, was once again Ecuador (480,000 inhabitants), while the country with the largest cities in terms of average population was Argentina (1,000,000 inhabitants). However, in the considered period, the region's megacities grew in terms of population. The largest metropolitan areas of Latin America in 2010 are, in descending order, Sao Paulo (23.2 million inhabitants), Mexico City (20.5 million inhabitants) and Buenos Aires (14.1 million inhabitants).

Regarding city density, panel C of Graph 1.5 (p. 48) shows that, as in all regions studied in the previous section, between 2000 and 2010, average population density decreased in all the studied countries. This drop, however, is not of the same magnitude in all countries: while in Argentina density drops by 28%, in

38. According to the evidence presented in Text box 1.3 (see p. 37), between 2000 and 2010 the Metropolitan Area of Buenos Aires incorporates the city of La Plata (to the southeast) and Sao Paulo integrates the cities of Campinas, Indaiatuba and Itu (to the northwest).

Venezuela it drops by 8%. In the 10 years studied, the lowest average population density in cities with more than 100,000 inhabitants is observed in Argentina (37 inhabitants per hectare in 2000 and 27 inhabitants per hectare in 2010), and the highest in Peru (92 inhabitants per hectare in 2000 and 81 inhabitants per hectare in 2010).

Megacities and urban primacy

The agglomeration economies discussed in the conceptual framework suggest the existence of a positive relation between the size of a city and its productivity (see Text box 1.1, p. 29). However, this does not imply that the optimal size of a city is infinite and that, in order to maximize productivity, each country (or, in fact, the world) should have a single large city. As also discussed in the conceptual framework, congestion costs increase with the size of the city. Cities with poor transport networks and services, excessive regulation of the housing supply, a precarious public transport system and lacking metropolitan coordination, among other factors, will have very high congestion costs and, therefore, may hold a smaller amount of population or, alternatively, run the risk of oversizing.

The objective of this subsection is not to explain the reasons for the existence of inefficiently large megacities in Latin America compared to developed regions. Some of the theories that the literature offers in this respect are as follows: i) the late urbanization of developing regions took place after the epidemiological transition, which made mortality rates in these cities much lower than those experienced during the urbanization processes that occurred in the 19th century, and the natural growth of the population in late urbanization cities was greater (Jedwab and Vollrath, 2017); ii) political and institutional factors specific to some developing countries, such as high agricultural taxes or the assignment of urban public employment in exchange for political support, and other distorting public policies, such as excessive trade protectionism, generate a bias in favor of those living in the larger cities of these countries (Bates, 2005, Krugman and Elizondo, 1996); iii) specialization in the production and export of primary products which, by promoting the production of non-tradables in large urban consumer markets, favors population concentration (Gollin et al., 2016).

The purpose of this subsection, on the other hand, is to examine in detail the size distribution of cities, to check whether Latin America shows an important primacy of a few cities. A useful tool for this is the so-called Zipf's Law. In essence, the law says that the probability for the size of a city to be greater than a given value S is proportional to 1 / S (Gabaix, 1999a). In other words, if we consider the N cities from a country and sort them according to their size from 1 to N, the city in position i will have a population equal to that of the largest city divided by i. So, the second city will have half the population of the first, the third, one third, and so on.[39]

39. This is equivalent to saying that the size distribution of cities follows a "power law", with a power parameter equal to 1.

The Zipf's Law is a commonly used methodology is to study the size distribution of cities and make comparisons between countries and regions. Compliance with Zipf's Law (and hence Gibrat's Law, explained below) implies that cities follow a growth dynamic which is independent of their own size and is due to exogenous productivity shocks (Gabaix, 1999b, Duranton and Puga, 2014).[40] Text box 1.4 shows an example of a Zipf's Law estimation for Mexico.

This empirical regularity is an interesting reference point for a descriptive analysis of the potential primacy of a country's main cities. In that sense, the most important input is a measure that allows comparisons between countries (Duranton and Puga, 2014). While authors like Chauvin et al. (2017) compare countries using different definitions of city extension (metropolitan areas in the United States, micro-regions in Brazil, cities in China and districts in India), BEAM allows the same definition to be used for all the world's countries.

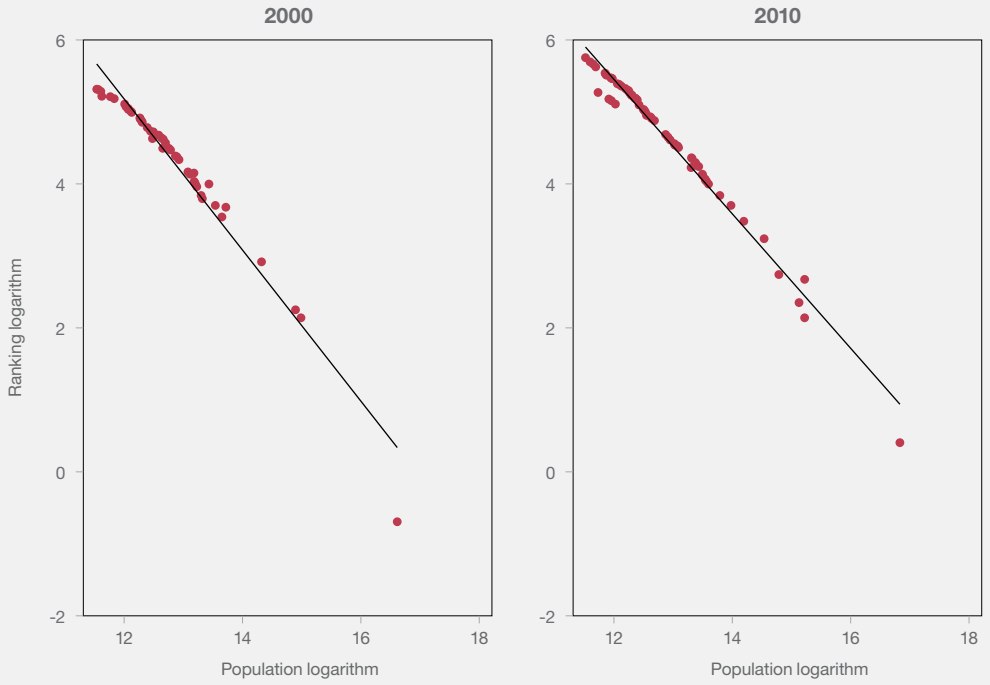
Text box 1.4 Applying Zipf's Law in Mexico

If Zipf's Law is satisfied, the coefficient that correlates the logarithm of the position of each city in the descending size ranking with the logarithm of its population must be equal to -1 (Gabaix, 1999a). If the estimated coefficient is greater than -1 (or its absolute value is less than 1), this suggests that cities ranked in an order lower than the first are large (in population) in relation to Zipf's prediction, and there is no primacy of the main city. On the other hand, if the coefficient is less than -1 (or its absolute value is greater than 1) this would indicate that the cities of order lower than the first are small (in population) relative to the Zipf prediction and there is a primacy of the main city in the city-size distribution within a country.

In order to visualize Zipf's Law we can look at a country, for example Mexico, and order the cities of more than 100,000 inhabitants (estimated by BEAM) decreasingly according to their population. The most populated city (Mexico City) will have a value of log(1) = 0; the second (Guadalajara) will have a value of log(2) = 0.3, etc.[a] The logarithm of this ranking is plotted on the vertical axis of Graph 1, while the horizontal axis shows the population logarithm of the corresponding city. If the resulting points in the plane are superimposed on a straight line with a slope equal to -1, the empirical size distribution of Mexican cities complies with Zipf's Law.

40. According to Gabaix (1999a), Zipf's Law applied to the size distribution of cities is one of the most precise empirical regularities in economics, since it holds true in all countries and periods for which data is available. However, authors such as Black and Henderson (2003) and Eeckhout (2004) discuss whether Zipf's Law applies to this phenomenon

Graph 1 Zipf's Law and the size distribution of Mexican cities in 2000 and 2010 [a/]



a/ The graph exhibits compliance with Zipf's Law in Mexico. It shows the regression using ordinary minimum squares between a city's ranking logarithm minus 1/2 and its population logarithm.

Source: Author's elaboration using data from BEAM (CAF, 2016) and Ch et al. (2017).

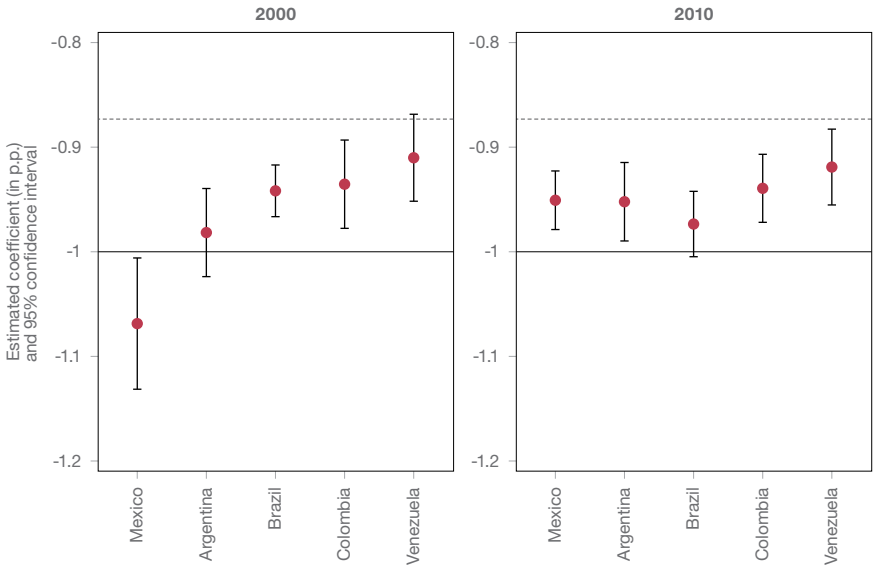
The estimated coefficients for Mexico are -1.07 in 2000 and -0.95 in 2010. While these figures are very close to Zipf's Law, which predicts a coefficient of -1, the coefficients are statistically different from that value. In this sense, it is interesting to note that Mexico went from experiencing a primacy of its larger city (Mexico City) with respect to other cities in 2000 (coefficient <-1) to having secondary cities that are larger than predicted by Zipf in 2010 (coefficient > -1). That is, between 2000 and 2010, Mexico's most important population growth occurred in cities other than the capital. Indeed, according to BEAM, while the population of Mexico City increased 25% between 2000 and 2010, that of the three following cities in terms of size (Guadalajara, Monterrey and Puebla) increased 38% on average.

a. Gabaix and Ibragimov (2011) and Chauvin et al. (2017) show that, in practice, one should subtract ½ from the ranking before the logarithmic transformation. Furthermore, Zipf's Law does not necessarily adapt for small cities, which is why the exercise is usually done for cities with more than 100,000 inhabitants.

Graph 1.6 shows the results of an exercise similar to Mexico's (reported in Text box 1.4, p. 51) for other countries in the region. This exercise can only be performed in some countries, since the number of metropolitan areas with more than 100,000 inhabitants is too small in most countries of the region to estimate a linear regression model. In particular, results are reported for Argentina, Brazil, Colombia, Mexico

and Venezuela.[41] The estimated coefficient of correlation between the logarithm of the size ranking of cities greater than 100,000 inhabitants and the corresponding population logarithm is greater than -1 and is statistically significant in most cases. As discussed in Text box 1.4 (p. 51), Mexico is an exception in 2000 because the coefficient is less than -1. Meanwhile, in Argentina (in 2000) and in Brazil (in 2010) the coefficient is not statistically different from -1.[42]

Graph 1.6 Relation between the logarithm of the cities' ranking according to their population and the population logarithm for Latin American countries a/ b/ c/ d/



a/ The graph shows the coefficients and 95% confidence intervals, estimated by ordinary least squares with robust errors. The dependent variable is the logarithm of the cities' ranking (plus ½) according to their population. The independent variable is the population logarithm.
b/ The dotted horizontal line shows the estimated coefficient for the United States.
c/ The horizontal continuous line at -1 is the value predicted by Zipf's Law.
d/ Calculations are made for cities with more than 100,000 inhabitants. For 2000 and 2010, 20 and 26 cities are used in Argentina, 73 and 102 cities in Brazil, 18 and 26 cities in Colombia, 46 and 67 cities in Mexico, 19 and 30 cities in Venezuela, respectively.

Source: Author's elaboration using data from BEAM (CAF, 2016) and Ch et al. (2017).

41. Strictly, only Brazil and Mexico have enough cities with more than 100,000 inhabitants: 73 cities in 2000 and 102 cities in 2010 for Brazil, 46 cities in 2000 and 67 cities in 2010 for Mexico. Argentina, Colombia and Venezuela do not have as many cities, so the estimated results for these three countries should be interpreted with caution, as they may be biased (Argentina, 20 cities in 2000 and 26 cities in 2010, Colombia, 18 cities in 2000 and 26 cities in 2010, and Venezuela, 19 cities in 2000 and 30 cities in 2010). Indeed, the main weakness of Zipf's Law is that estimates of the relationship between population ranking and population (both in logarithms) are very sensitive to the size of the city sample.

42. Chauvin et al. (2017) find a significant coefficient of -1.18 for Brazil, which does indicate the primacy of Sao Paulo over other cities. The difference of this estimate with regard to the one reported in Graph 1.6 may be due to differences in the database. These authors use 319 "microregions" of more than 100,000 inhabitants, estimated by the Brazilian Institute of Geography and Statistics, as a unit of measurement. The number of metropolitan areas with the same population threshold, as estimated by BEAM, is 102 in 2000, which suggests that BEAM groups some of the census micro-regions together because they are part of the same metropolitan area according to the methodology of Ch et al. (2017). However, the coefficient shown in Graph 1.6 is almost identical to that estimated for this country by Soo (2014). This shows once again that the results of this type of exercise should be interpreted with caution.

There does not seem to be a primacy of large cities in Latin America. On the contrary, the trend suggests that intermediate cities in the region are increasing in size.

Another interesting and useful empirical rule for comparing countries in terms of their tendency of whether to favor the growth of large cities at the expense of smaller ones is Gibrat's Law. This law establishes that the population growth rate of a city does not depend on its size, as measured by its initial population. Compliance with the law means that the entire city system of a country or region grows, on average, at the same rate, regardless of size.

In contrast, a violation of this law may imply that the most populated cities grow more. The latter is consistent with the gradual formation pattern of megacities which, like "black holes", absorb much of the economic activity of a country, growing disproportionately, with the aforementioned consequences in terms of slum incidence, poverty, and congestion externalities.[43]

The empirical way to verify Gibrat's Law is to estimate the statistical association between the time variation of the cities' population and their initial population. If the resulting coefficient is not statistically different from zero, this is consistent with the fulfillment of Gibrat's Law. In contrast, a coefficient greater than zero indicates a tendency to give primacy to larger cities at the expense of smaller ones.[44]

Graph 1.7 shows the corresponding estimates for Latin American cities with more than 100,000 inhabitants. The estimated coefficient is negative and significant, indicating not only that the initially larger cities in the region do not grow faster, but that between 2000 and 2010 it was in fact the smaller cities that grew faster.

This matches the results from the analysis of Zipf's Law, which do not seem to reveal a primacy of large cities in Latin America. On the contrary, the trend suggests that intermediate cities in the region are increasing in size. These statements, however, should only be considered and interpreted as suggestions. Indeed, as mentioned above, the results of such exercises attempting to estimate compliance with Zipf's and Gibrat's laws are sensitive to the way cities are measured, the size of the sample, the period of analysis, and the method of estimation.

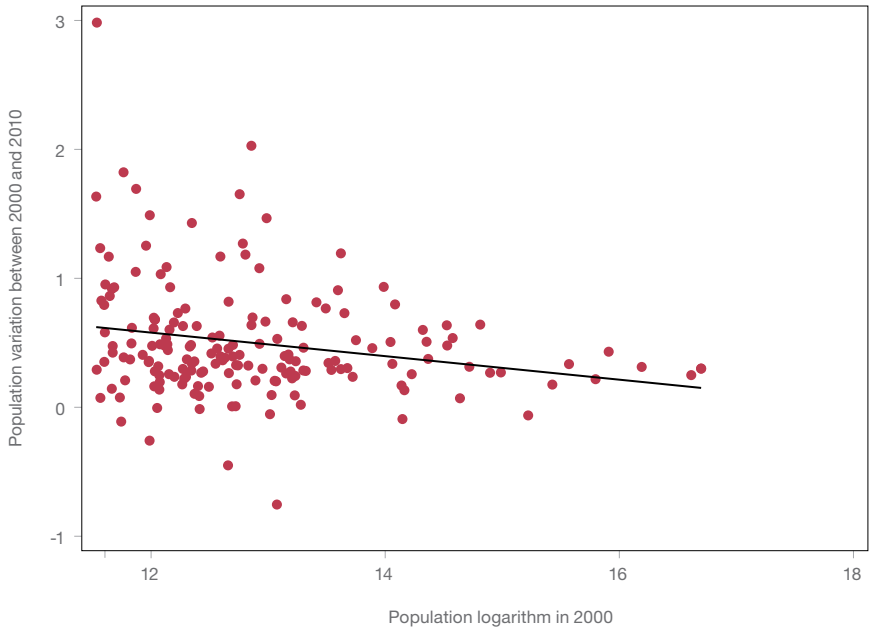
In addition, it is common for Zipf's Law to be fulfilled only for a subset of larger cities and not for all cities (Duranton and Puga, 2014). On the other hand, although the results reported in this section are consistent with estimates from authors such as Soo (2014), for Brazil, and Perez Valbuena and Meisel Roca (2014), for Colombia, other authors have observed different patterns (e.g. Chauvin et al., 2017).

---

43. In this sense, the relationship between the laws of Zipf and Gibrat is evident. Champernowne (1953) and Gabaix (1999a) prove that if Gibrat's Law is fulfilled, in equilibrium, the size of the cities should be distributed according to what is established by Zipf's Law.

44. To verify compliance with Gibrat's Law, a balanced panel is needed, i.e., the same city is needed in 2000 and 2010 in order to calculate growth. In the case of the metropolitan areas that emerge between these two years through the union of luminous pixels of two or more cities, the comparison is made with the aggregated population of the cities in 2000. For example, Buenos Aires and La Plata merge between 2000 and 2010, so the initial population is the sum of the population of these two cities in 2000.

Graph 1.7 Verifying Gibrat's Law in Latin American cities [a/]



a/ The graph shows the regression by ordinary least squares with robust errors between the urban population in 2000 and the percentage increase in population between that year and 2010.

Source: Author's elaboration using data from BEAM (CAF, 2016) and Ch et al. (2017).

Conclusions

Throughout history, urbanization has, in varying degrees, occurred hand in hand with the development process of every country. Most Latin American nations were urbanized in the second half of the 20th century, together with a batch of other countries with late-term urbanization that did not partake in the Industrial Revolution. Therefore, the urbanization process has not been particularly productive, giving rise to the current development gap in the region's urbanization: its per capita income is what the United States and Europe enjoyed more than 60 years ago, when their levels of urbanization were much lower than current Latin American levels. Indeed, because of its late development, accelerated and pushed by forces other than growth of productivity or innovation in industrial sectors and services with high added value, the cities in the region have not been able to take full advantage of the opportunities associated with the agglomeration of firms and workers at the same levels of urbanization in other countries. This implies that in Latin American cities, and in those of many developing countries, the negative externalities of congestion costs have a high relative weight.

The highest densities in Latin America are mostly explained by the presence of slums, which concentrate between 20% and 30% of urban population.

Compared with more developed regions, Latin American cities have similar population levels, but are substantially less extensive. The suburbanization of Latin America is incipient compared to that of Europe and, above all, the United States. The combination of these two facts means that population density rates in Latin America are relatively high. The highest densities in Latin America are mostly explained by the presence of slums, which concentrate between 20% and 30% of the inhabitants in Latin American cities.

To be fair, it must be said that this is not true for all the countries in the region. Due to their larger urban footprint, the densities of some cities in Argentina, Brazil, and Mexico are much lower than those of cities in Colombia, Peru, and Venezuela. However, in Andean countries the mountain range is a geographical barrier to the growth of cities. It is therefore important to note that the challenges of urban development are not the same throughout Latin America. Also, the region is not alone in this process, as sub-Saharan Africa and Southeast Asia, for example, face the same or even greater challenges as Latin America.

The good news is that large Latin American cities do not seem to act as black holes that gradually absorb all the economic activity of their countries. Instead, intermediate cities in the region are increasingly important. In recent years, the secondary cities of many countries have grown faster than the main ones.

Another good news is that, in part, the high rates of urbanization in Latin America today indicate that, for many people, urban opportunities are better than rural poverty. That is where the importance of fostering urban development in the region lies, striving for higher levels of accessibility and reducing the congestion externalities brought about by the urbanization process, resulting in greater wellbeing for most Latin Americans.

This section summarizes the main contributions of RED 2017 and highlights two different yet complementary dimensions. The first is the need to produce original, comparable and, in some cases, disaggregated and georeferenced information on the cities. Despite efforts made for this report, the lack of reliable quality data on the studied variables and aspects is perhaps the main hurdle to produce rigorous evidence that can contribute to the design of public policies.

The second dimension is that public policies aimed at making cities into drivers of productivity, growth and wellbeing must combine, in an integrated way the planning and regulation of land use, investments and policies in transport and mobility infrastructure, and improved access to housing and basic services. This combination of policies promotes accessibility (to jobs, services, amenities), which makes cities a central factor in the development process. However, the success of urban development policies also depends on mechanisms (formal or informal) of sectoral coordination and coordination between institutions at the metropolitan level, since many of the problems of a city extend to the surrounding areas. This is why comprehensive, coordinated and legitimate solutions are required in the metropolitan area.

The need to produce more information

The diagnosis presented in each chapter of this book addresses the challenge of having to work with information which is scarce in the region and has limitations in terms of quality and space-time coverage. This may be the reason that urban development has been poorly studied in Latin America.[45]

That is why the preparation of RED 2017 involved the production of new information. Efforts in this regard focused on two databases that, as of this publication, will become public property for researchers and policy makers in the region.

The first database is presented in this chapter and has been called BEAM. The second database is the 2016 CAF Survey. Since 2008, CAF has conducted an annual survey among individuals in their households, in major Latin American cities. As an input for this report, the 2016 edition of 2016 CAF Survey included specific modules on urban accessibility and the costs of living in cities. A further contribution from 2016 CAF Survey is the implementation of surveys in slums: in addition to a sample of urban "formal" households, about 500 households were surveyed in slums in four of the 11 cities which make up 2016 CAF Survey. Sampling was designed in a way to make sure that the surveys were representative of the slums of each city.[46]

Main results and implications for public policies

RED 2017 documents a stylized fact with important implications for public policies that seek to improve the development of Latin American cities and the wellbeing of their inhabitants: cities in the region have a high population density compared to cities in developed countries. The section "Diagnosis: urbanization of Latin America in comparative perspective", in this chapter, presents evidence based on data which was prepared especially for this report using satellite images of nighttime luminosity. Chapter 2 confirms it based on alternative sources of information. Particularly, it presents the population density over the constructed area, calculated by the AUE. It shows that the density of cities in the region is almost double that of European cities and four times that of North American cities, matching results for population density calculated over the total urban area.

---

45. The World Bank (2009) and CAF (2010) are previous studies on the economic geography of Latin America and the challenges of subnational territorial development, respectively. Also noteworthy are recent reports produced by the World Bank for Mexico (Kim and Zangerling, 2016) and Argentina (Muzzini et al., 2016), and the report of the Latin American office of the same institution on productivity in the Latin American system of cities (with an estimated date of publication in 2018). CAF has also recently contributed to the study of this issue (Silva and Vaggione, 2016).

46. The 10 cities included are Buenos Aires, La Paz, Fortaleza, Sao Paulo, Bogota, Quito, Mexico City, Panama City, Lima and Caracas. Slum surveys were conducted in Buenos Aires, Fortaleza, Bogota, and Caracas.

As discussed in the conceptual framework, the larger size of a city is associated with higher agglomeration gains, but also with higher congestion costs. The net aggregate effect on wellbeing depends on the city's accessibility, which reflects the balance between agglomeration gains and congestion costs. The productivity of a city increases when firms can access skilled labor, quality inputs and a stable demand for their products. Wellbeing improves when people can access more and better jobs, decent housing, quality services, entertainment, and other people with similar interests and tastes.

Thus, the concept of accessibility summarizes the effects of economic and social interactions that take place in urban spaces on productivity and wellbeing. An accessible city reduces real distances between people and businesses and enhances the benefits of agglomeration. This can occur with high or low density levels. For example, accessibility can be lower in cities with high density if it generates high congestion costs. For this reason, one of the main messages of this report is that the debate surrounding public policy should not necessarily focus on the need for more or less compact cities, but on promoting greater accessibility.

How to improve urban accessibility? The following chapters, whose main messages are summarized below, discuss three fundamental dimensions that are intimately connected: land-use regulations, mobility and transport, and access to housing and basic services. The way to ensure integration between these dimensions of policy in the metropolitan area is through governance schemes which consider the need for coordination at the territorial and sectoral levels.

Chapter 2 argues that a primary reason that most cities in Latin America have not been able to take advantage of their relatively high level of urbanization is inadequate infrastructure, both in transport and public services. Scarce infrastructure, coupled with restrictive land-use regulations, has not allowed cities in the region to absorb migratory flows by expanding their size in an orderly fashion and facilitating access to the economic opportunities they offer. In this context, population growth in Latin American cities has increased the incidence of slums, where housing conditions are precarious and access to quality jobs and basic services is limited.

Indeed, many large cities in Latin America are characterized by high levels of informality in the housing market and public transport, limiting access to formal employment opportunities for a large percentage of the population. This "triple informality" (in housing, transportation and employment) is largely responsible for the low levels of productivity and wellbeing observed in many Latin American cities.

The analysis of land use patterns and the determinants of urban structure is fundamental to understand the structural factors that hinder accessibility in Latin American cities and, therefore, to identify the most appropriate corrective measures. These include a broad set of policies that combine regulatory elements such as the flexibilization of the housing supply or the implementation of taxes and subsidies to reduce congestion, with investments in transport infrastructure and public services. However, rather than discussing specific issues that hinder

accessibility and how to overcome them, the public policy debate in developing countries often focuses on whether cities should expand or remain compact. It is as if expansion or compactness were objectives in themselves, and the basic purposes of urban development policies were forgotten: productivity, wellbeing or, in short, accessibility.

The public policy debate in developing countries often focuses on whether cities need to expand or remain compact.

In part, the debate between expansion and compactness is responsible for the idea, which is quite common among policymakers, that a growth in sprawl is undesirable because it increases travel times at the expense of the city's productivity and the quality of the environment. In line with this view, available evidence suggests that, although there is a great deal of variability within Latin America, the expansion of cities in the region has been moderate, and in most cases, disorderly, compared to other regions.

Chapter 2 challenges this generalized belief by arguing that if the growth of the urban footprint is accompanied by adequate transport and service infrastructures and proper land-use regulations, it can improve access to quality formal housing without compromising access to jobs, services and amenities. In fact, the decentralization of the urban population can promote the emergence of economic subcenters in peripheral areas, improving the city's productivity and the wellbeing of its inhabitants. This alternative approach is even more relevant if one considers that the increase in average household income and technological improvements that cheapen mobility generate a growing demand for urban space: families want to live in larger houses, especially if this does not require large sacrifices in terms of displacement.

Chapter 3 analyzes how access to employment opportunities, social services and amenities depends mostly on people's ability to move inside the city. Urban mobility is, therefore, a key element for achieving accessibility.

Mobility determines both the size of agglomeration economies and the magnitude of their congestion costs. On one hand, mobility difficulties prevent people from accessing the best available jobs and prevent firms from hiring the most skilled labor, which reduces the productivity of the whole city. On the other hand, poor mobility is one of the main causes of congestion costs, such as traffic, environmental pollution, road accidents and other phenomena that negatively affect the wellbeing of the population.

One of the most important factors that determine urban accessibility is mobility infrastructure, which not only covers motorized transport (public and private) but also alternative means such as cycling or walking. In fact, Chapter 3 documents the relevance of public transportation and commuting by foot in the region: 39% of Latin Americans move from their residence to their place of work in public transport, 22% in private transport, and 26% on foot. This compares with values of 23%, 54% and 11%, respectively, in Europe, while in the United States 90% of home-to-work commutes are done in a private car.

At the same time, evidence shows that the existing mobility infrastructure in the region is scarce and inadequate compared to cities in developed countries.

This is particularly the case for alternative means, other than private motorized vehicles. Furthermore, the limited infrastructure is used inefficiently and inequitably, since little space is usually allocated to sidewalks or exclusive lanes for public transport, even though these forms of mobility are the most frequent alternative among the lower income population. Likewise, high rates of road insecurity in Latin America (even after controlling for the level of development) indicate the pedestrian infrastructure needs urgent improvement.

Although the extension of Latin American cities is small compared to cities in developed countries, commute times are excessively high due to poor mobility infrastructures. According to 2016 CAF Survey, the average Latin American takes 40 minutes from his home to his place of work (not counting the return time). In cities like Sao Paulo, Bogota, Mexico City and Lima, a quarter of the population takes at least one hour to get to work every day.

On the other hand, the different ways of mobilizing within cities have different consequences in terms of the associated congestion costs, as well as distributive implications. Private vehicles in particular (automobiles and motorcycles) produce the greatest negative externalities associated with traffic, environmental pollution and the incidence of traffic accidents. Moreover, cars are used, to a greater extent, by higher-income socio-economic groups. In this sense, the report stresses that public policies should create mechanisms for those who impose costs on society through their behavior to compensate with a payment that is proportional to the damage they cause.

This is worrying because while urban population in Latin America has increased by about 10% since the end of last decade, in the same period the fleet of cars has grown more than 40%, and motorcycles have almost tripled. This trend could be strengthened by the secular increase of the average income in cities, since families tend to use the car more as their income rises.

Chapter 3 discusses an extensive set of policies that share the goal of improving urban accessibility by reducing the congestion costs of cities through the regulation of private vehicle use and the promotion of public transport. The chapter advocates a public policy approach that holds car and motorcycle users responsible for the social cost of their mobility. To do so, there are two types of regulatory instruments: i) initiatives that seek to match the private cost of using a car with its social cost, such as traffic taxes in certain areas and during heavy traffic hours; ii) actions that aim to restrict the use of vehicles on certain days and times, depending on, for example, the license plate number. Chapter 3 discusses international and Latin American experiences in this regard and shows that the effectiveness of these policies varies according to their design and implementation. Such is the case of traffic restriction policies, which are often counterproductive because they encourage the expansion of the vehicle fleet.

However, the success of such initiatives does not occur in isolation to public transport coverage or the quality of the service. Unfortunately, public transportation in Latin American cities faces important challenges in both coverage and quality. Chapter 3 documents this insufficient coverage: 1 in 5 Latin Americans cannot

access any form of public transportation within 10 minutes of their home. Although the informal transportation supply covers some of the coverage deficiencies, about 15% of slum inhabitants in the region do not have access to any form of public transportation (formal or informal). Coverage limitations are not only due to the long distances of the public transportation system across different residential areas, but also because of the high costs in relation to the income of the region's poorest households (who use public transport the most and, to a large extent, rely on it to access opportunities). Regarding quality, evidence shows that 1 in 4 Latin Americans are dissatisfied with the public transport service, either because of its low frequency, excessive travel times or because of the insecurity of the vehicles that provide the service. Although extending coverage and improving the quality of public transport are priorities in Latin America, the two objectives are often mutually exclusive. For example, while subsidies to public transport tariffs may increase its use, this strategy could also undermine the quality of the system (in addition to having a high cost for taxpayers).

Latin American housing markets have structural issues that limit cities' ability to fully exploit the benefits of agglomeration.

Another very important element for accessing a city's opportunities is the people's place of residence in relation to the location of their work, basic services, amenities and other people in the city. In this sense, Chapter 4 argues that the proper functioning of the housing market is fundamental for accessing quality housing. However, evidence in that chapter suggests that Latin American housing markets present a series of structural issues that limit the ability of cities in the region to fully enjoy the benefits of agglomeration.

One of these issues is the relatively poor quality of housing in Latin American homes. Housing deficits in the region are evident, for example, in the limited access to public services, with consequences on health conditions and skill accumulation. A second relevant issue is the low affordability of housing, which is explained by high prices (purchase or rent) considering the low income, as well as by the low availability of mortgage credit. In the absence of cheap and extensive financing sources, access to housing is severely limited, especially for low- and middle-income households. This, in turn, encourages developers to only build units for those who can afford them, constraining the housing supply for the vulnerable sectors and encouraging the search for informal solutions. Indeed, the third problem of the region's housing market is its duality: there is a formal market that serves the wealthiest sectors of the population and an informal market that facilitates access for the poorest sectors, which can usually only access low quality units.

The flexibility of the housing supply determines the internal structure of a city, because as agglomeration economies increase productivity and, therefore, average wages, new workers migrate to the city and demand housing. From this perspective, an inflexible housing supply will cause prices for existing units to rise and, unless new migrants are located in slums, employment in the city will not grow. On the other hand, a flexible supply that responds to an increasing demand with new units will absorb new jobs. In this sense, the flexibility of the residential supply is fundamental for taking advantage of the productive opportunities offered by agglomeration economies in terms of employment and better wages.

As discussed in Chapter 4, in addition to its functional role as a critical determinant of access to the opportunities of a city, housing has an intrinsic value since its characteristics are associated with the wellbeing of its inhabitants. Indeed, a house located in a marginal and dangerous social and physical environment, built with precarious materials, insufficient spaces and without a connection to public service networks, does not generate the same level of wellbeing as a house located near parks and recreation centers, built with solid materials and ample spaces. Likewise, quality housing promotes better health conditions and enables a greater accumulation of skills, which translates into higher levels of productivity for its inhabitants, regardless of their greater or lesser accessibility.

For these two reasons (access to opportunities and wellbeing associated with habitat), it is considered that states should facilitate access to quality housing for the entire population. However, as documented in Chapter 4, the reality of Latin America is far from this ideal scenario. Cities in the region are characterized by a high incidence of slums, where households live in precarious conditions (without accessibility or quality of life). In fact, 1 in 5 Latin Americans live in precarious housing conditions.

Based on available evidence on the housing markets in Latin America in a comparative perspective, Chapter 4 highlights four elements that should be at the center of any housing public policy discussion in the region. The first element is that housing shortages or deficits depend on both supply factors (inefficiency in the housing sector) and demand factors (poverty level). The second element states that the rigidity of the housing supply limits the effectiveness of policies to stimulate demand (for example, access to mortgage credit). This implies that the priority of public policies should be the flexibilization of supply. To this end, simplifying land-use regulatory frameworks and building standards is essential, as well as streamlining bureaucratic processes for building permits and property registries, among other measures.

Third, Chapter 4 shows that, due to the coexistence of formal and informal real estate markets (the duality of the real estate market), initiatives that are implemented in one market will affect the other. In this sense, the chapter argues that a sustainable decline in the incidence of slums requires the formal housing market to function efficiently and, at the same time, to increase the income (and access to credit) of the poorest sectors, reducing the relative price of living in the formal city. In contrast, social housing programs that seek to relocate slums in new projects often limit the accessibility of these households by locating them in peripheral areas with low connectivity to the economic centers of the cities. For example, a social housing program recently implemented in Rosario, Argentina, led to a 7 percentage points fall in the employment rate of the beneficiaries, due to a lack of opportunities in the area.

Finally, the fourth element is that the policies' objective should be to guarantee access to quality housing, but not necessarily ownership. Therefore, proper functioning of the rental markets, which in Latin America have traditionally been relegated to the background, plays a fundamental role to achieve the ultimate goal of accessibility. In that regard, rent regulations should be rationalized, a

legal framework that equally covers owners and tenants should be promoted, and price controls should be avoided.

Despite the technical quality of many policies discussed throughout this report, and their shared purpose of improving accessibility in Latin American cities, Chapter 5 shows that successful interventions in areas such as land use, mobility and the housing market depend, to a large extent, on metropolitan governance.

Cities must rely on institutional arrangements that allow the formulation and implementation of policies in an efficient and effective manner, through transparent, participatory, and therefore legitimate, decision-making processes. This is important since the formulation and implementation of policies usually involve institutions from different levels of government, the private sector and civil society. Furthermore, the administrative boundaries of a city rarely coincide with the economic and social dynamics that unfold within it, making reliance on policy coordination mechanisms necessary at the metropolitan level.

In the absence of coordination mechanisms, policy effectiveness is limited and the decisions of different local governments regarding land use, transportation and housing will generate externalities for the surrounding municipalities' inhabitants, affecting their well-being. Transport networks, for example, often transcend the administrative boundaries of a municipality, making metropolitan coordination necessary to improve mobility (and thereby accessibility) for the inhabitants of all municipalities sharing the same network.

Based on the review of scarce evidence and paradigmatic case studies, Chapter 5 argues that, beyond the existence of formal cooperation agreements, the success of metropolitan institutional arrangements depends on three fundamental pillars: the complexity of coordination and the institutional capacity of involved entities, the availability of human and financial resources, and the political legitimacy of metropolitan coordination bodies and their decisions. In particular, economic segregation and the high incidence of informal settlements in several Latin American cities, which also partially explain the mutual mistrust between citizens and municipal governments, make mechanisms of credibility and legitimacy important to achieve sustainable governance schemes. Furthermore, citizen participation can be an effective control tool for municipal management.

The region has, overall, weak metropolitan governance due to a lack of capabilities, resources and political legitimacy. Unfortunately, this limits the possibilities for coordinating policies and bringing Latin American cities to a new equilibrium in which the advantages of agglomeration predominate, leading to more productive cities with higher levels of wellbeing among their inhabitants.

There are several obstacles for the creation of metropolitan coordination mechanisms. These have to do with the feasibility of supra-municipal institutions, the diverse nature of local governments' interests, and political economy factors. The first is that the national government's structure makes the creation of metropolitan governance bodies more or less feasible. For example, in federal

Institutional strengthening and state capacity at the metropolitan level are needed to better coordinate policies capable of increasing urban accessibility.

governments such as Brazil, the implementation of coordination mechanisms between municipalities is easier than in centralist governments.

As for the diversity of interests, the differences in size, administrative capacities and availability of resources among local governments are such that, on some occasions, governments with greater capacities refuse to finance projects that will benefit the inhabitants of their smaller peers. The opposite can also happen, since sometimes small local governments fear losing autonomy by coordinating with their wealthier peers.

Finally, the personal incentives of politicians often translate into the implementation of urban policies that do not maximize accessibility for the population. For example, politicians sometimes prefer carrying out visible and short-term projects that give them political benefits. Although long-term investments may be better in terms of social wellbeing, if they exceed the local government period, the political returns are smaller. This points toward the need to develop sound monitoring and evaluation of institutions and processes.

In short, institutional strengthening and state capacity at the metropolitan level are needed to better coordinate policies that can lead cities towards greater accessibility.

Appendix

Urbanization rate for developed and developing regions (Graph 1.1)

The regions are comprised as follows:

Africa includes Algeria, Burkina Faso, Ivory Coast, Egypt, Ethiopia, Ghana, Iran, Kenya, Madagascar, Malawi, Mali, Mauritania, Mauritius, Senegal, Sri Lanka and Tunisia.

Latin America includes Chile, Colombia, Ecuador, El Salvador, Guatemala, Mexico, Panama and Peru.

North America includes the United States.

Europe includes Germany, Belgium, France, Holland, England and Sweden.

Asia includes Bangladesh, China, South Korea, India, Indonesia, Japan, Jordan, Fiji, Philippines, Malaysia, Pakistan and Thailand.

Relationship between urban population and the logarithm of per capita gross domestic product in 1870 and 2010 (Graph 1.2)

The regions are comprised as follows:

For 1870:

Africa includes Egypt, Ghana, Iran, Iraq and South Africa.

North America includes Canada and the United States.

Latin America includes Argentina, Brazil, Chile, Colombia, Cuba, Mexico, Peru, Uruguay and Venezuela.

Asia includes Burma, China, North Korea, South Korea, India, Japan and Malaysia.

Europe includes Germany, Austria, Belgium, Bulgaria, Denmark, Spain, Finland, France, Germany, Greece, Holland, Hungary, Ireland, Italy, Norway, Poland, Portugal, United Kingdom, Romania, Russia, Serbia, Sweden and Switzerland.

Oceania includes Australia.

For 2010:

Africa includes Angola, Saudi Arabia, Algeria, Bahrain, Benin, Botswana, Burkina Faso, Burundi, Cape Verde, Cameroon, Chad, Comoros, Congo, Ivory

Coast, Egypt, United Arab Emirates, Eritrea, Ethiopia, Gabon, Gambia, Ghana, Guinea, Guinea Bissau, Equatorial Guinea, Iran, Iraq, Israel, Jordan, Kenya, Kuwait, Lesotho, Lebanon, Liberia, Libya, Madagascar, Malawi, Mali, Mauritania, Mauritania, Mauritius, Mozambique, Namibia, Niger, Nigeria, Oman, Qatar, Central African Republic, Republic of the Congo, Rwanda, Sao Tome and Principe, Senegal, Seychelles, Sierra Leone, Syria, Somalia, Swaziland, South Africa, Sudan, Tanzania, Togo, Tunisia, Turkey, Uganda, Yemen, Djibouti, Zambia and Zimbabwe.

Latin America includes Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Cuba, Ecuador, El Salvador, Guatemala, Haiti, Honduras, Jamaica, Mexico, Nicaragua, Panama, Paraguay, Peru, Dominican Republic, Trinidad and Tobago, Uruguay and Venezuela.

Asia includes Afghanistan, Bangladesh, Burma, Cambodia, China, North Korea, South Korea, Philippines, Hong Kong, India, Indonesia, Japan, Kazakhstan, Kyrgyzstan, Laos, Malaysia, Mongolia, Nepal, Pakistan, Singapore, Sri Lanka, Thailand, Tajikistan, Turkmenistan, Uzbekistan and Vietnam.

Europe includes Albania, Germany, Armenia, Austria, Azerbaijan, Belgium, Belarus, Bosnia and Herzegovina, Bulgaria, Croatia, Denmark, Slovakia, Estonia, Spain, Finland, France, Georgia, Greece, Holland, Hungary, Ireland, Italy, Latvia, Lithuania, Macedonia, Moldova, Montenegro, Norway, Poland, Portugal, United Kingdom, Czech Republic, Romania, Russia, Serbia, Sweden, Switzerland, and Ukraine.

North America includes Canada, the United States and Puerto Rico.

Oceania includes Australia and New Zealand.

World Regions for Latin American cities according to BEAM (Graphs 1.4 and 1.7)

Sub-Saharan Africa includes Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Chad, Ivory Coast, Eritrea, Ethiopia, Gabon, Gambia, Ghana, Kenya, Madagascar, Malawi, Mali, Mauritania, Mozambique, Namibia, Niger, Nigeria, Democratic Republic Congo, Republic of the Congo, Rwanda, Senegal, South Africa, Sudan, Tanzania, Togo, Uganda, Djibouti, Zambia and Zimbabwe.

North America includes Canada and the United States.

Latin America includes Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Uruguay, and Venezuela.

Western Europe includes Germany, Austria, Belgium, Denmark, Slovakia, Spain, Finland, France, Holland, Ireland, Iceland, Italy, Norway, Poland, Portugal, United Kingdom, Sweden, and Switzerland.

Southeast Asia includes Burma, Cambodia, Philippines, Indonesia, Laos, Malaysia, Singapore, Thailand and Vietnam.

THERE IS ROOM FOR GROWTH: LAND USE AND URBAN STRUCTURE

Chapter 2

Chapter 2

THERE IS ROOM FOR GROWTH: LAND USE AND URBAN STRUCTURE[1]

Introduction

Latin American cities have significantly higher population densities than the cities of Europe and North America.[2] The average density in the region is 90 inhabitants per hectare, which is 80% higher than that of Europe (51 inhabitants per hectare) and more than four times that of North America (21 inhabitants per hectare). This relatively high population concentration is mostly due to the higher density of the larger cities (cities with more than 3 million inhabitants), which reach 120 inhabitants per hectare on average. In contrast, cities of Europe and North America with the same population range, show density levels about half and one-fifth, respectively, of that observed in Latin American megacities. For example, while in 2014 the metropolitan areas of New York and Mexico City had almost the same population (18 million inhabitants), the density of Mexico City (110 inhabitants per hectare) exceeded that of New York (25 inhabitants per hectare) by a factor of more than 4.

How does the region benefit from (or find itself affected by) high population concentrations? It is difficult to make normative arguments in favor of high or low densities, or more or less compact cities. As discussed in Chapter 1, more populated and denser cities foster agglomeration economies and productivity, but they also increase travel congestion, housing prices, and environmental pollution. The balance between these forces determines the productivity of a city's businesses and the wellbeing of its inhabitants. The net gains of the agglomeration forces are greater if intensive land use is combined with an adequate infrastructure for mobility, housing, water and sanitation. However, as will be seen throughout this chapter, this does not appear to be the case of most cities in the region. On the contrary, relatively high densities are due in part to the fragile mobility infrastructure, among other services, which has not allowed an orderly growth of the urban extension making more difficult the absorption of migrants who are attracted by the greater opportunities of the city. This has forced a high concentration of the population into central areas, where employment is generally located.

The high demand for housing in these central areas and restrictive land use regulations have led to an increase in housing prices, pushing many low and

1. This chapter was written by Cynthia Goytia and Pablo Sanguinetti, with research assistance from Jonathan Cohen and Matías Italia.

2. In this report, the term North America encompasses the United States and Canada, while Mexico is included in Latin America.

The "triple informality" (in housing, transport and work) that characterizes the cities of Latin America significantly reduces their productivity.

middle-income families out of the formal market. This phenomenon has boosted the informal housing market, with the emergence of new slums, and the growth and densification of existing ones. In these settlements, or neighborhoods, located on public (often occupied illegally) or on squatered private land, in both central and peripheral areas of the cities, livebetween 20% and 30% of the population of large metropolitan areas in Latin America. Furthermore, many of these settlements, especially those located in central areas, have very high densities, which explains to a large extent the high population concentration in the region's major cities.

Likewise, the lack of access to public transport, especially in suburban areas, has led to the emergence of a wide range of informal travel services that lack regulation, are low-quality, and prone to high accident rates.[3] Deficiencies in access to transport and housing, in turn, hinder access to employment, which strengthens the labor informality phenomenon so prevalent in the region's labor markets. Thus, cities in Latin America (and generally in developing countries) are characterized by a "triple informality" (in housing, transport and work) that significantly reduces the cities' productivity and, thereby, affects the economic performance and wellbeing of countries.

The unplanned growth of Latin American cities has resulted not only in high densities but also in an inadequate land use pattern, understood as the allocation of urban space to different activities. This chapter seeks to document this pattern by describing the structure of the cities of the region in terms of location of economic activity and employment, as well as households. Studying this pattern, understanding the forces that generate it and observing its evolution over time is a fundamental input for the design of urban land use policies.

As established throughout this chapter, cities can take on different shapes, which require different policy approaches. For example, the dynamics of firm and household location can follow a "monocentric" model, characterized by a strong concentration of employment and housing in the central areas. In this model, as the distance to the center increases, employment and housing density decreases sharply, which is reflected in lower land prices. Alternatively, the structure of land use could be better explained by a model where economic activity is located in several subcenters, distributed throughout the urban geography. This more decentralized pattern of economic activity implies a more dispersed pattern for the population's location. In this type of "polycentric" cities, with much larger suburban areas, population density is lower and decreases much more slowly as distance to the center increases. Available evidence for the metropolitan areas of Latin America shows that, in general, the urban structure is consistent with a monocentric model.

3. Chapter 3 describes the evidence on these informal transportation services in detail.

There are economic forces and aspects of the mobility infrastructure and technology that determine the urban form. Agglomeration economies tend to offer strong incentives for firms to concentrate on certain locations. As the availability of jobs decreases with distance to such locations, housing prices, and construction density declines. The high population density in downtown areas favors the development of mass public transport (metro, buses and train services) with a radial orientation towards the center, further consolidating the concentration of business activity in these locations. Alternatively, technological advances such as those permitting the mass-production of automobiles and its complementing road infrastructure (for example, highway construction), along with virtual connectivity and truck transportation, could favor greater decentralization of employment and population in the cities.

The relatively high densities of Latin American cities suggest that, in the future, many cities may face a greater demand for growth in urban extension.

Furthermore, the extent to which land use regulations favor agglomeration economies and reduce the costs or the negative congestion externalities is a critical aspect influencing city productivity. For example, the promotion of industrial activities can contribute to the creation of high income jobs but, at the same time, increase pollution. However, regulations may pursue different objectives than resolving externalities (or "market failures"). In that sense, the interplay of interests may lead to inadequate policies or "governance failures", as in the case of regulations that set minimum limits for plots that are too large for residential single-family use. These regulations can generate fractures or discontinuities in the urban structure and, at the same time, directly affect the families' possibilities to access housing in the formal sector, a subject that is explained in detail in Chapter 4.

The relatively high densities of Latin American cities suggest that, in the future, many cities in the region may face a greater demand for growth in urban extension, a process that will be reinforced further by the increase in household income, massification of automobile use, technological change, the construction of roadways and improvements in public transport.

What can be learned from the growth of cities in the region in recent years? What have been the consequences of this growth in terms of density and population distribution throughout the urban territory? To what extent has this growth led to a greater decentralization of residential and employment uses? What is the relationship between these urban growth patterns and the indicators of urban segregation and inequality? This chapter will seek to answer these questions by focusing on aspects of public policy related to land use regulations and planning. As will be seen in these pages, land use policies cannot be dissociated from those that focus on improving mobility and access to housing. However, the analysis of the specific issues associated with the diagnosis and the policies in mobility and housing is developed in Chapters 3 and 4, respectively.

A comparative perspective of land use dynamics in Latin American cities

To analyze land use patterns, we must be able to access disaggregated and georeferenced information from within the urban conglomerates. The scarce availability of this type of data for variables such as population and employment densities, built-up area, land prices, etc. in Latin America has made it difficult to carry out empirical studies that lead to a deeper understanding of the determinants and effects of different urban growth patterns in the region.[4] However, geographic information systems (GIS), new spatial analysis technologies and high-definition satellite imagery provide alternative sources of innovative data that are now used to produce indicators of urban structure and extension in a wide sample of cities. Satellite imagery, for example, allows the consistent measurement of a set of spatial attributes that can be compared between cities and over time.

Chapter 1 presents an example of this methodology by using satellite imagery of nighttime luminosity to measure the extension of metropolitan areas in all cities in the world (see Text box 1.3, p. 37). This section uses an alternative database, the Urban Expansion Atlas (AEU for its acronym in Spanish), developed by UN-HABITAT (the United Nations agency for human settlements), the Lincoln Institute for Land Policies, and the University of New York (AEU, 2016).[5] This database uses daytime satellite images as the basic input to identify contiguous built-up areas, with the goal of measuring the extension of urban areas, the density of their construction, the incidence of suburban areas and the extension of unbuilt intra-urban spaces. As mentioned in Chapter 1, the problem with this database is that it only contains a small sample of cities of the world (around 200), of which only 26 belong to Latin America. However, one of its advantages is that it allows estimations of the density in terms of built-up area and understanding in detail the cities' growth patterns through the differentiation of central and suburban areas.

The analysis presented in this section classifies the cities included in the AEU into three categories, corresponding to the three terciles of the distribution of the cities by population: i) small cities, of up to 500,000 inhabitants; ii) intermediate cities, from 500,000 to about 3 million inhabitants; and iii) large metropolises and megacities, with more than 3 million inhabitants. For comparative purposes, information is presented for both Latin America and North America (excluding Mexico) and Europe.[6]

4. In contrast, in the countries belonging to the Organisation for Economic Co-operation and Development (OECD) these issues have been widely studied.

5. Angel et al. (2016a, 2016b) present the data from the Atlas of Urban Expansion (AEU).

6. The Appendix to this chapter lists the 26 cities in Latin America, the 16 cities in North America, and the 16 cities in Europe that make up the sample.

Population density

The average population density of Latin American cities in 2015 is significantly higher than that of cities in North America and Europe.

There are two complementary definitions of population density. The first measures the population concentration in the total urban area (including open spaces) and the second is restricted to built-up areas. Total density, used to compare the entire region with other regions of the world (see Chapter 1), is always lower than density over the constructed area. Furthermore, by including urbanized open space, this measurement is affected by the city's level of fragmentation.[7]

As noted in this chapter's introduction, the average population density (over the constructed area) of Latin American cities is higher than that of cities in North America and Europe. Graph 2.1 (see p. 76) shows the average density levels for the three city categories, classified by size, in the three indicated regions. We see that the average density of cities in Latin America in 2015 (90 inhabitants per hectare) is significantly higher than the average of North America (21 inhabitants per hectare) and Europe (51 inhabitants per hectare). These differences remain for the three city sizes, although they are greater for larger metropolises (with more than 3 million inhabitants): 120 inhabitants per hectare in Latin America versus 25 inhabitants per hectare in North America and 60 inhabitants per hectare in Europe.[8]

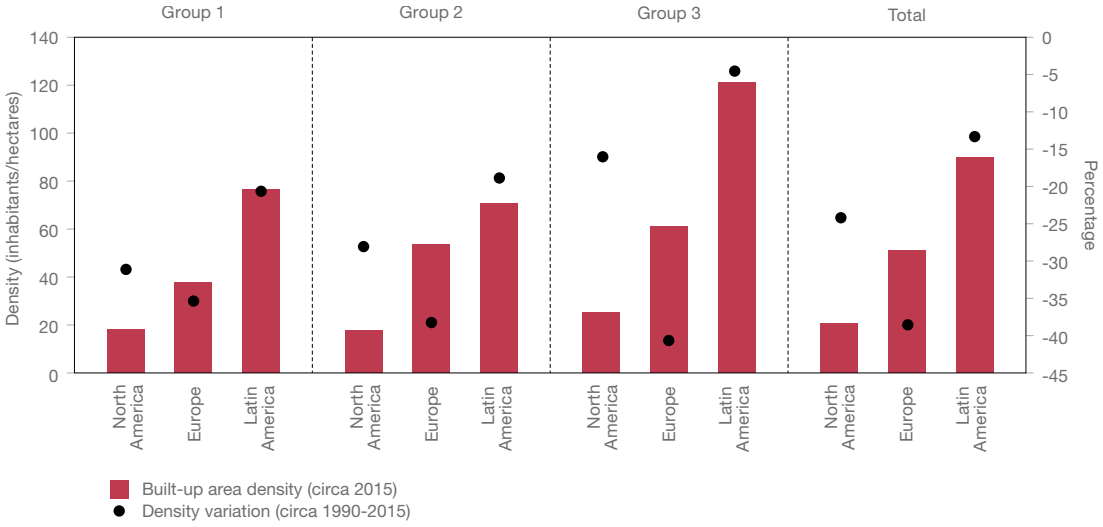
The density comparison between cities in Latin America and developed countries for a given year is illustrative and seems to confirm the hypothesis of a more intensive use of urban land in the region. However, we must also evaluate the variation of this indicator over time, since it could reveal dynamics capable of changing, in the long run, the general picture observed in the most recent period. In that sense, Graph 2.1 (see p. 76) shows information on density changes for the period circa 1990-2015. We may observe that in all three regions there is a tendency towards decreasing densities in the last decades. However, there is significant heterogeneity in the magnitude of the changes: while for the whole set of Latin American cities density fell by 13% on average, in North America the drop was almost twice that figure and in Europe it was about three times. In the case of the larger cities, in those 25 years, density in Latin America fell only by 4%, while in Europe the drop in density is very similar for all size categories. Within Latin America, the case of Bogota stands out, where the density

7. The concept of "fragmentation" refers to the degree of discontinuity in the urban structure due to the existence of open spaces (e.g., parks, empty floor-space, etc.). The available fragmentation indicators, such as the saturation indicator (proportion of built-up space over extension) or the open space indicator (open space available within a 1 km radius around each constructed pixel), suggest that Latin America does not behave very differently to cities in Europe or North America, which indicates that the aggregate density patterns established in Chapter 1 would be robust using density over built-up area.

8. Within this category of large metropolis, in Latin America the cities of Bogota (245), Caracas (190), Sao Paulo (113), Mexico City (109), and Santiago de Chile (107) stand out for their greater density, expressed in inhabitants per hectare. In the case of the great metropolis of Europe, among those with greater density Madrid (93), London (63), Berlin (56) and Paris (55) stand out; while in North America densities drop significantly for cities of comparable size such as Montreal (34) and Los Angeles (32), New York (24), Portland (21), Houston (19) and Chicago (17).

over built-up area increased by 35% (from 180 inhabitants per hectare to 245 inhabitants per hectare) during that period.

Graph 2.1 Average population density over built-up area and its variation over the period circa 1990-2015, for selected cities in North America, Europe and Latin America [a/ b/]



a/ The graph shows, on the left axis, built-up area density for the total of cities and the average for the three city categories in North America, Europe and Latin America. The right axis exhibits the percentage variation of density over the period circa 1990-2015..
b/ Group 1 includes cities with up to 500,000 inhabitants; group 2, between 500,000 and 3,000,000 inhabitants approximately, and group 3, with more than 3,000,000 inhabitants. See the Appendix for the complete list of cities.

Source: Authors' elaboration using data from the AUE, Angel et al. (2016a).

In conclusion, population density in Latin America is not only much higher than in the developed world, but it is also decreasing at much lower rates, meaning that if the trend continues, density gaps will increase.

Urban sprawl and city growth: Central and suburban areas

Urban sprawl or the physical extension of Latin American cities is smaller than that of its peers in North America and Europe (see Chapter 1). Table 2.1 complements the evidence provided in Chapter 1 based on the AEU, which shows the total urban extension of the cities, the percentage of the land occupied by built-up areas, by open space, and the proportion of constructed space in central or suburban areas for all three regions.[9] According to this

9. The AEU defines suburban areas as those areas of the city with less constructive density. In particular, those areas where only between 25% and 50% of the pixels show buildings (see note b/ in Table 2.1).

source of information, there is a significant difference in the extension of the built-up area, reaching 34,543 hectares on average in Latin America[10], a figure equivalent to almost 63% of the average area in European cities (55,000 ha) and about one-fifth of the urban built-up area in North America (169,000 ha). This difference holds for larger metropolises, although there are considerable variations within the group. For example, Santiago de Chile has a built-up area equal to a third of Milan, Italy (60,000 hectares versus 180,000 hectares), while the population of both cities is similar (6.5 million inhabitants). Another interesting comparison involves Caracas and Montreal, both with a little more than 3 million inhabitants and an urban extension difference of approximately 6 to 1 (in favor of Montreal).

The extension of the built-up area in Latin America represents approximately one-fifth of the urban built-up area in North America.

The smaller size of the built-up area in Latin American cities is not because they have larger unbuilt urban open spaces (such as large parks, forests or just empty spaces). On the contrary, as shown in Table 2.1, these cities have a comparatively low proportion of undeveloped urban areas (28% in Latin America compared to 34% in Europe and 36% in North America).

Table 2.1 Total urban extension and average built-up area for selected cities in North America, Europe and Latin America, circa 2015 [a/ b/]

		Total urban extension (hectares)	Total urban extension		Built-up area		
			Built-up area (%)	Urbanized open space (%)	Urban (%)	Suburban (%)	Rural (%)
North American average	Group 1	37,121	59	41	69	29	2
	Group 2	182,716	59	41	71	27	2
	Group 3	544,308	72	28	85	14	1
	Total	263,715	64	36	75	23	2
European average	Group 1	7,751	68	32	78	20	2
	Group 2	48,094	63	37	75	23	2
	Group 3	199,846	67	33	81	18	1
	Total	82,909	66	34	78	21	1
Latin American average	Group 1	6,288	71	29	80	19	1
	Group 2	27,150	69	31	82	17	1
	Group 3	105,861	76	24	88	11	1
	Total	47,977	72	28	84	15	1

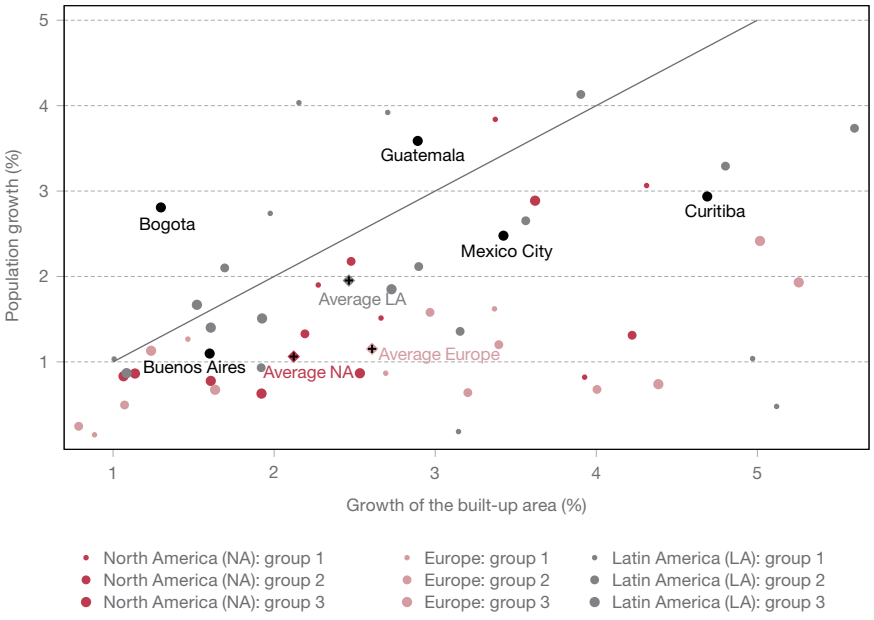
a/ Group 1 includes cities of up to 500,000 inhabitants; group 2, between 500,000 and 3,000,000 inhabitants approximately, and group 3, with more than 3,000,000 inhabitants. See the Appendix for the complete list of cities.
b/ The urban extension is made up of built-up area and urbanized open space. Likewise, based on satellite images, each constructed pixel is classified into three types depending on the "walking distance circle" (defined as a circle of 1 km² equivalent to a 10-minute walk) surrounding it: urban (if more than 50% of the circle's pixels are built), suburban (when between 25% and 50% of the pixels are built) and rural (with less than 25% of built-up pixels).

Source: Authors' elaboration using data from the AUE, Angel et al. (2016a).

10. This figure arises from the multiplication of the percentage of constructed area for the average of all the cities of Latin America (72%) by its total urban extension in hectares (48,000 hectares). The other figures follow the same logic based on the data in Table 2.1.

On the other hand, Graph 2.2 shows the evolution of the built-up area in the cities of the AEU sample during the period circa 1990-2015 and compares it with the evolution of the population in the same period. The 45° line indicates equal growth in both variables, which implies that density should remain the same. However, in all three regions, on average, cities grew more in terms of built-up surface than population (which accounts for the decreases in density reported in Graph 2.1, p. 76). However, while this is true individually for cities in Europe and North America, in Latin America this average hides a much greater heterogeneity among cities. For example, while Bogota and Curitiba (Brazil) had approximately the same population growth between 1990 and 2015 (close to 3% per year), the growth of the built-up area in Bogota was between 3 and 4 times lower than in Curitiba (1.4% versus 4.8% per year).

Graph 2.2 Relationship between population growth and built-up area growth during the period 1990-2015 for selected cities in North America, Europe and Latin America [a/ b/]



a/ The annual growth rates for the population and the built-up area are used. The 45 ° line indicates that the population growth coincides with that of the built-up area.
b/ El grupo 1 incluye ciudades de hasta 500.000 habitantes; el grupo 2, de entre 500.000 y 3.000.000
b/ Group 1 includes cities of up to 500,000 inhabitants; group 2, between approximately 500,000 and 3,000,000 inhabitants, and group 3, with more than 3,000,000 inhabitants. Due to scale issues, the extreme values of the cities Halle (Germany), Palmas (Brazil), Raleigh and Springfield MA (United States) are not shown. See the appendix for the complete list of cities.

Source: Authors' elaboration using data from the AUE, Angel et al. (2016a).

The smaller built-up surface of Latin American cities is due in part to the fact that built-up suburban areas are smaller compared to North America

and Europe, both in terms of absolute extension and in proportion to the total built-up surface of the cities. As reported in Table 2.1 (see p. 77), the built-up suburban area in Latin America occupies, on average, 15% of the constructed area, while in North America and Europe it is 23% and 21% respectively.

The smaller urban extension of the built-up area in Latin America is due to the fact that the suburban areas are not as large as in North America and Europe.

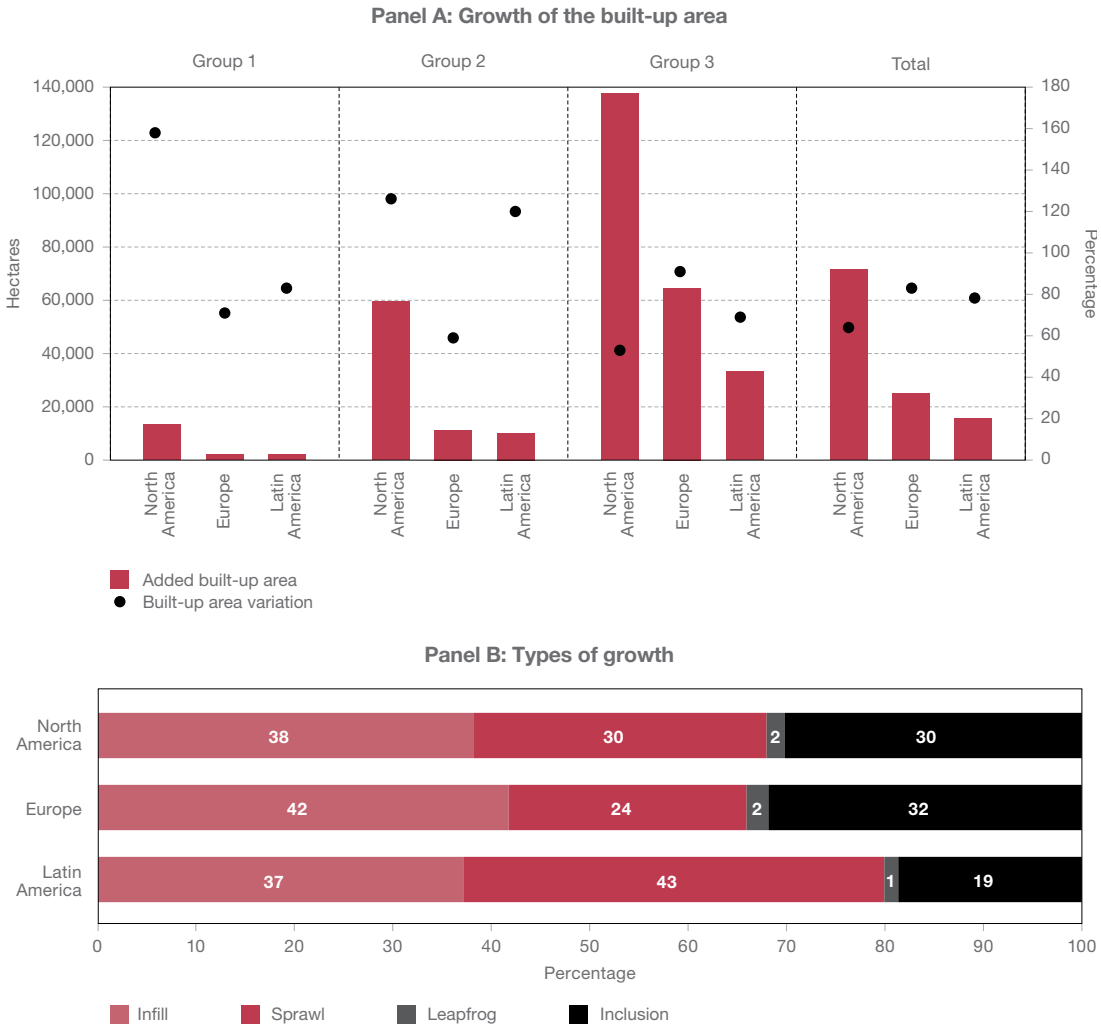
The high densities observed in several Latin American cities suggest that, in the future, they may face an increasing demand for built-up land. The AEU distinguishes four different sources of urban extension growth, depending on the location of the new areas that are incorporated to the city: i) infill growth, whereby newly built-up areas occupy previously vacant areas within the existing urban borders; ii) sprawl or growth in extension, which occurs when the urban boundaries continuously extend beyond existing constructions; iii) leapfrog growth, which occurs when newly built-up areas are separated from the preexisting urban area; and iv) growth by inclusion, which occurs when urban areas that were not previously contiguous merge through the urbanization of the intermediate zones that separated them. Together, these four categories make up the whole of a city's growth in its physical extension.

Panel A of Graph 2.3 (see p. 80) describes the growth pattern of the built-up area in the cities of the AEU sample. Although the percentage growth of the total built-up area between 1990 and 2015 in all three regions is not very different (Latin America, with 77% growth, is in between North America, with 64%, and Europe, with 83%), absolute growth is quite different: while cities in Latin America grew by an average of 15,000 hectares, in North America it was approximately 72,000 hectares, and in Europe, 25,000 hectares. As for the growth's breakdown, panel B of Graph 2.3 (see p. 80) suggests that cities in Latin America saw an increase in their built-up land through a sprawl of the urban space, while in the cities of the other two regions, growth was due mostly to the infill of the existing area and the inclusion of other previously non-contiguous metropolitan regions.[11] As always, averages hide an interesting variation. In Bogota, for example, the already documented strong growth in population density for the period 1990-2015 (from 180 inhabitants per hectare to 245 inhabitants per hectare) is mainly explained by an infill in of its urban area. In contrast, in Guadalajara (Mexico), growth through urban sprawl was favored over urban infill, thereby decreasing the density of the built-up area from 105 inhabitants per hectare to 85 inhabitants per hectare.[12]

11. This phenomenon described by the AEU, and which is especially pronounced in European cities, is also pinted out in the analysis conducted in Chapter 1 based on CAF's Database on the Extension of Mteropolitan Areas (BEAM).

12. In comparative terms, while cities such as Berlin, Madrid and Milan incorporated 48,000 hectares of constructed area between 1990 and 2015, in the same period cities of similar population in Latin America only incorporated 8,000 hectares.

Graph 2.3 Growth of the built-up area and types of growth over the period 1990-2015 for selected cities in North America, Europe and Latin America [a/ b/ c/]



a/ The graph in panel A shows the added area in hectares for all the cities and the average for the three city categories in North America, Europe and Latin America. The right axis shows the percentage variation of the built-up area.
b/ The graph in panel B shows the percentage of each type of growth for the average of the cities in North America, Europe and Latin America.
c/ Group 1 includes cities of up to 500,000 inhabitants; group 2, between 500,000 and 3,000,000 inhabitants approximately, and group 3, with more than 3,000,000 inhabitants. See the Appendix for the complete list of cities.

Source: Authors' elaboration using data from the AUE, Angel et al. (2016a).

Informal land use

In addition to the quantitative growth of cities, both in population and in the expansion of the built-up area, it is relevant to describe some of the characteristics that can help determine the quality of that growth. In particular, one of the characteristics to be considered is the extent to which cities have planned their

urban expansion, or if it responds instead to informal processes of territorial development. Generally, cities that expand their constructed area in an orderly way can allocate land for road networks (main and secondary),[13] define an appropriate mix of uses (with residential amenities and good allocation of public spaces), and preserve vulnerable environmental areas by protecting them from urbanization.

Measuring the incidence of slums in Latin American cities poses significant challenges in terms of methodology and data availability.

On the other hand, when urban growth occurs through the illegal occupation of public or private land (by families and companies), the State loses the capacity to allocate land to different urban needs (such as streets or parks), hindering the provision of basic services (such as water, sanitation and energy) in these neighborhoods. It is also difficult for families located in these areas to invest in their home, given the irregular land tenure and lack of services.[14] In this sense, the quality of urban habitats in slums is much lower than in the formal city. Nonetheless, as discussed in more detail in Chapter 4, these precarious housing solutions are the only housing alternatives for many low-income households that cannot access housing in the formal market.

The incidence of slums in Latin American cities is evident. However, the rigorous measurement of this phenomenon poses considerable challenges in terms of methodology and data availability. For its part, the AEU defines as "informal development areas" spaces that present irregularities in the urban structure (for example, very small lots, narrow streets, lack of sidewalks and public lighting). However, this methodology relies exclusively on satellite images, and does not contrast areas that are detected as informal with complementary information coming from censuses or surveys.[15]

Notwithstanding these limitations, the estimation of the incidence of "informal development areas" provided by the AEU constitutes a good starting point for analyzing such visible phenomena as is the impact and evolution of slums in Latin American cities. Graph 2.4 (see p. 82) shows both the incidence of slums before 1990, and the growth of these areas in the period circa 1990-2015.[16] It can be observed that since 1990 the incidence of this phenomenon has increased significantly in Latin American cities (from 16% to 36%), while it is practically non-existent in North America and very low in Europe (5% in the most recent period). This city growth, defined by a significant informality that affects the cities of all three considered size ranges, highlights the difficulties that all cities in the region have faced when planning their growth in an orderly manner.

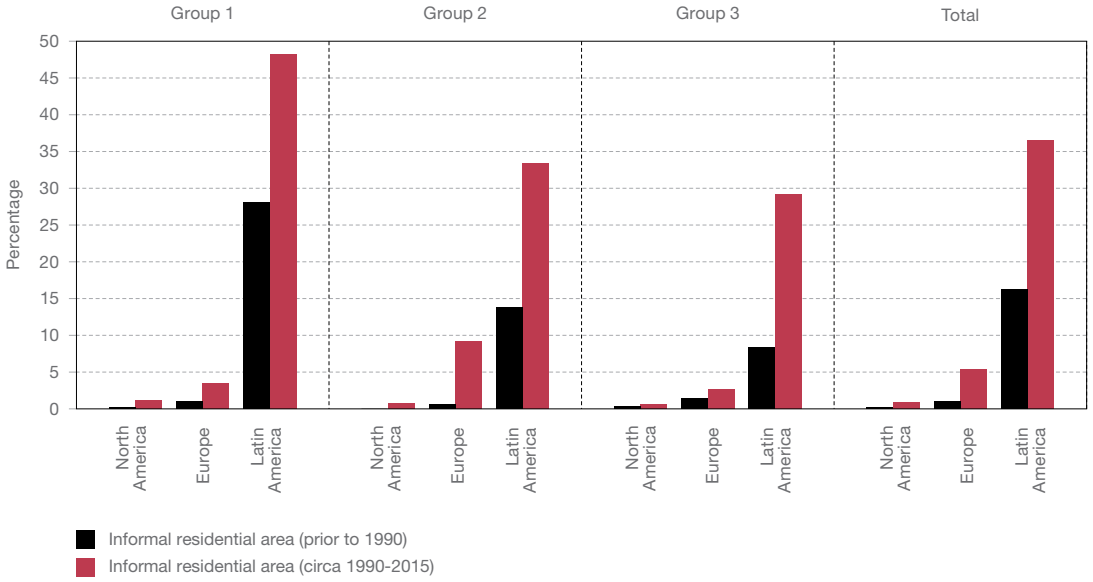
13. The information provided by the AEU on the allocation of space for roadways shows that in recent decades (1990-2014) the proportion of land destined for streets and avenues fell on average from 25% to 20% of the urban built-up area in the large metropolitan areas of the region.

14. See Chapter 4 for a more detailed discussion of this aspect.

15. This comparison is important because the existing definitions of slums, such as that of UN-Habitat, highlight housing characteristics that are not detectable from satellite images, such as connection to basic services and ownership of the land or property. This, however, does not imply that the precarious access to services and the informality of tenure are not correlated with certain urban patterns that are indeed detectable through satellite imagery. However, the predictive capacity of the physical characteristics that are captured by satellites must be documented in order to evaluate the accuracy of these estimates.

16. The estimations made for both periods are not entirely comparable since the one made until 1990 is an indicator of slum incidence within the total built-up area until that date, whereas the one made for the period circa 1990-2015 is valid for the newly built surface area in this period.

Graph 2.4 Average evolution of areas of informal development, in different periods, for selected cities in North America, Europe and Latin America [a/ b/]



a/ Based on satellite images, areas with irregularities in the urban structure (eg very small lots, narrow streets, absence of sidewalks and lack of public lighting) are defined as areas of informal development.
b/ Group 1 includes cities of up to 500,000 inhabitants; group 2, between approximately 500,000 and 3,000,000 inhabitants, and group 3, with more than 3,000,000 inhabitants. See the Appendix for the complete list of cities.

Source: Authors' elaboration using data from the AUE, Angel et al. (2016a).

The evidence described throughout this section suggests that Latin American cities are characterized by high population densities that, despite having decreased in recent years, are still significantly higher than those observed in developed countries (where, in addition, density has been falling at much higher rates). In comparative terms, the region's relatively high densities are due in part to the weak growth of the cities' physical span, explained in turn by a low development of suburban areas. This weak growth in span has created pressure in terms of housing demand that, not having been properly addressed, has led to the emergence of slums, both in central and peripheral urban areas. This informal land use phenomenon has intensified in recent years to such an extent that today it represents more than a third of the urban territory of the region.

This analysis, although aggregated, points towards the need to promote the development of suburban areas in Latin American cities, through the provision of mobility infrastructure and other services in peripheral areas. However, policy design requires a better understanding of the relationships between land use and urban development, for which a rigorous analysis of more disaggregated information from within the cities is essential, describing the evolution of population density, employment, land use and prices, among others. Before presenting this analysis, a brief conceptual framework must be introduced to

understand how market forces and public policies (such as those involving mobility infrastructure, other services and land use regulations) determine the internal structure of cities. This conceptual framework will make it possible to derive a series of hypotheses that can later be contrasted with disaggregated information from within the cities.

Conceptual framework: Determinants of land use and the internal structure of cities

Just as agglomeration economies and congestion costs are important determinants of rural-urban migration and the balance of system of cities (see Chapter 1), these same forces also affect population distribution, densities and the price and use of land within the cities.

The presence of agglomeration economies means that firms producing goods and services tend to settle close to one another, clustering on specific areas within the cities' geography, and thereby forming a central business district (CBD). Initially, the exact location where the firms cluster and the CBD is established may be determined by historical or institutional issues or geographical accidents. However, workers and their families must choose their place of residence and the size of their home by considering the fact that employment is located in the CBD. For example, although land prices are lower at a greater distance from the CBD, and therefore larger housing is available, it is also true that, at a greater distance, commuting costs to the CBD, where employment is located, will be greater (both in terms of money and time).

This simple monocentric model produces very intuitive predictions that can be studied using available information:[17] i) the prices of housing and land (per square meter, m^2) decrease with distance to the center or to the area with the greatest concentration of economic activity; ii) construction density also decreases with distance to the CBD, while housing consumption increases; iii) population density decreases with distance to the CBD.

The evolution of these variables throughout the city's geography can be represented by curves or gradients. The slopes of these curves are determined by the cost of moving between the place of residence and the workplace, and, therefore, by the mobility infrastructure.[18] In particular, if transport costs fall as a result of public investments (for example, in new highways) or due to technological

17. Seminal studies that develop the monocentric model of urban economics are Alonso (1964), Mills (1967), and Muth (1969). Brueckner (1987) develops a graphic and intuitive explanation of the model. See also Fujita (1989) for a classic reference. Duranton and Puga (2015) present a version of the model that incorporates several extensions.

18. Although the classical model of urban economy is based on transport costs and their reduction through efficient infrastructure, similar conclusions can be drawn for other network services such as water and sanitation.

Evidence for the United States shows how the emergence of the automobile and the massification of its use may explain the decentralization that these cities underwent.

development (e.g. mass-use of the automobile), the gradients flatten (the curve shifts downwards, and its slope is reduced). This means, for example, that land prices drop (more significantly in central areas) and that they fall on average at a lower rate as distance to the CBD increases. Mobility infrastructure and technological development, therefore, make cities grow in terms of their physical size due to growing suburban areas (i.e., suburbanization), and in terms of their population (congestion costs are reduced and, consequently, the net wage increases, bringing more migrants to the city).[19] In general, growth in urban extension is greater than that of the population, which is why densities decrease across the cities' entire geography.[20]

Another implication of the model is that increases in income triggered by causes different from agglomeration forces (such as technological advances that improve the aggregate productive structure or increased access to credit) generate a greater demand for housing space by households, who prefer larger spaces as their income rises. Because the price of housing is lower with greater distance to the CBD, the population moves away from the center, which results in a physical expansion of the city and a decrease in population density.[21] In other words, the long-term development process and policies that reduce credit barriers (especially with regard to mortgage credit) have implications for the structure of cities in terms of their size and density.

The empirical validity of the monocentric model has been studied in the United States, where it has been demonstrated that the emergence of the automobile and the massification of its use was one of the main forces behind the strong decentralization that these cities underwent since the second half of the 20th century (Glaeser and Kahn, 2004). Duranton and Turner (2012) find similar results for interstate highway construction, while Margo (1992) finds evidence consistent with the hypothesis that income growth in the United States between 1950 and 1980 was accompanied by increases in the urban footprint and reductions in density. Furthermore, Glaeser and Shapiro (2002) and Voith (1999) show that greater access to mortgage credit (for example, through a reduction in interest rates) increased the demand for suburban housing in this country.[22] In Latin America, however, rigorous studies of the model's implications are scarce. As we wil see below some descriptive evidence for the Metropolitan Area of Buenos Aires suggests that the development of interurban highways (especially those leading to the north and west of the city) promoted the suburbanization of the city.

19. See the conceptual framework in Chapter 1.

20. For the derivation details of these results see Duranton and Puga (2015).

21. If the increase in income occurs for all cities (and for the rural sector) because of an aggregate technological change, the population will not increase in any city and the expansion of urban boundaries will generate a drop in density.

22. In Latin America, however, the mortgage loan market is incipient (with the exception, perhaps, of Chile), which constitutes an obstacle for the demand for housing with greater space and therefore for the extension of the city. Chapter 4 discusses in detail the functioning of this market in the region.

Decentralization of employment

The monocentric model is not the only one that accounts for the observed land use patterns and urban structures. For example, the assumption that cities have a single business center, where all employment is concentrated, is a simplification that bears little resemblance with the actual structure of modern urban agglomerations. In fact, although most cities have a CBD with a strong concentration of firms, businesses and jobs, they also develop other subcenters that are located throughout their geography.[23] This suggests that a more realistic framework for studying job and housing locations across the city's geography should contemplate the fact that the location choices of firms and households are jointly determined. On the one hand, companies want to be close to other companies to take advantage of agglomeration economies and the associated productivity increases; however, high land prices in the CBD can more than offset gains in productivity, inducing them to locate in other areas. On the other hand, workers want to be close to jobs to reduce transportation costs, but high property prices in the CBD lead many workers to relocate to other areas. Therefore, the interaction between firms and families can lead to much more varied land use configurations than suggested by the monocentric model.[24] In particular, subcenters may arise with a lower density of firms and jobs in relative terms (Henderson and Mitra 1996, Glaeser and Kahn 2004).[25]

The number and size of subcenter depends largely on the mobility infrastructure and other services. In fact, for a subcenters to be economically attractive to firms, it must be connected to the rest of the city and to the CBD, and must have digital connectivity and communications services. To the extent that the fixed costs of providing this infrastructure are low, a greater number of subcenters may arise throughout the city (Glaeser and Kahn, 2004).

This more general model allows to explain some facts regarding the changes in the internal structure of cities in the last decades. In particular, the automobile massification that has driven residential decentralization in many developed countries, coupled with the development of freight transportation by truck, has reduced the fixed costs for establishing productive subcenters. This factor, in turn, has also favored the decentralization of employment (Glaeser and Kahn, 2004).

---

23. For example, Sao Paulo (Brazil), which is one of the largest cities in Latin America, has 33 subcenters with a certain concentration of jobs and firms, in addition to the main CBD (Garcia-López and Moreno-Monroy, 2016).

24. Ogawa and Fujita (1980) and Imai (1982) develop the model with endogenous location decisions of firms and families. Lucas and Rossi-Hansberg (2002) generalize the results found in these previous papers. See also Fujita and Thisse (2013). In the version of the model developed by Duranton and Puga (2015), it is shown that under a certain configuration of parameters mixed use -residential and commercial- areas emerge close to the CBD, a bit further exclusive commercial subcenters come up, and finally, further away, lower density residential areas arise.

25. The firms' decisions to locate close to families or other firms will depend on the characteristics of these firms in terms of sectors of activity, production technology, input requirements, etc. Some firms will want to be closer to input suppliers or infrastructure critical to their operation (such as highways, in the case of distribution companies), while others will prefer to be closer to final consumers (such as retailers).

The presence of amenities throughout the city's geographical span seems to play a central role in the spatial patterns of economic segregation.

Income differences and socioeconomic segregation

Another element that the basic monocentric model does not consider is that families differ in terms of their income (as well as in relation to other sociodemographic variables, and their preferences). This difference in households's characteristics gives rise to a series of questions that the basic model cannot answer, such as, where would the richest families and the poorest families be located and under what circumstances can socioeconomic segregation occur within the city. Answering these questions requires an understanding of how the demand for housing and the transportation costs vary with changes in income. As already mentioned, as household incomes increase, their housing consumption also increases (both in terms of quantity and quality). This encourages higher income households to move to suburban areas, where the price per square meter is lower. However, gains in housing space and quality coexist with higher transportation costs, which are higher for high-income families given their greater opportunity cost of time. Thus, if the first effect more than compensates for the second, a perfect segregation should be observed: poor families living in more central areas and high-income families living in suburbs.

According to Glaeser et al. (2008), this is the pattern of socioeconomic segregation that can be observed in several cities in the United States, supporting the argument that for North American high-income families the benefits of living in larger houses more than offset the higher travel costs. However, this phenomenon is not evident for all cities within the United States (for example, in New York and San Francisco) or Europe. In the latter, in fact, the opposite phenomenon predominates: high-income families live in relatively central areas. Furthermore, this type of segregation has not been widely observed in Latin American cities either.

This contrasting evidence suggests that it is difficult to justify the spatial patterns of socioeconomic segregation in cities by appealing only to travel costs and to the demand for land as a function of income. Other determinants, such as the presence of amenities across the city's geography, also seem to play a central role.

Amenities and congestion costs

Basically, the monocentric model and the extensions discussed so far conceive cities as labor markets where the families' location choices are made by weighing accessibility to employment against cost of land and house size. However, a more realistic view should incorporate the fact that cities offer other things besides jobs. As described in Chapter 1, amenities (and negative externalities) are also key determinants in families' (and businesses') decisions to locate in a city. The incorporation of these elements can give rise to more varied urban structures (uses, land prices, densities), while opening a wider menu of options for public policies. If, for example, the high density of productive activities in

the CBD produce some level of environmental degradation, noise pollution and traffic congestion, this could give relatively wealthy families more reasons to settle in peripheral areas of the city. Meanwhile, lower-income workers remain in the center, where environmental pollution and poor quality of life reduce the price of housing, which adds to the savings in transportation costs.[26]

Land use regulations may respond to a need for resolving market failures.

On the other hand, intensive land use in central areas increases the costs of providing amenities such as parks and open spaces, shopping centers and cultural spaces. To the extent that higher-income sectors value these amenities relatively more, the disparity in their supply deepens the possible segregation process.

As mentioned earlier, in some cities in the United States, relocation and segregation by income, partly associated with the deterioration of traditional urban centers, was very important in the 1970s and 1980s (Cullen and Levitt, 1999 Baum-Snow and Lutz, 2011). On the other hand, the fact that the historic centers of European cities hold valuable cultural and touristic assets maintained the appeal for high-income families to be located in the center. Therefore, in European cities there is a mixed use (commercial and residential) of CBD land. In this sense, as will be seen later in the section "Regulation of land use and the growth of cities", initiatives to revitalize and recover historic centers in Latin American cities could play a relevant role in combating urban deterioration processes and socioeconomic segmentation.

Land use regulations

The monocentric model (and the additional elements that have been incorporated in this section) assumes that land is regulation-free and that, therefore, its use is exclusively allocated through a competitive process (like an auction) whereby families or firms that are willing to pay more obtain ownership of the land and are free to decide its use (commercial, residential, industrial, etc.), and with what intensity. Clearly, this does not happen in reality. The regulations that affect land use are broad, and can take on the form of minimum lot sizes, minimum buffer zones, maximum limits for the built surface area per unit of land, restrictions on the types of activity or uses in each of the city's areas (residential, industrial, commercial, mixed), among others.

These regulations may respond to a need for resolving market failures. For example, when certain uses (such as industrial use) generate negative externalities (such as pollution), or when the market allocates little land to uses that produce positive externalities (because social benefits are significantly higher than private profits), such as parks and public transportation. However, regulations may also respond to other motives, such as historical considerations

26. Aspects related to crime incidence and the low quality of public services in downtown areas can be addressed as congestion costs. These two elements derive from the erosion of tax revenues generated by the relocation of high-income families (Inman, 1995). Chapter 5 deepens the analysis of city governance and financing aspects.

or political or economic interests. This is evident in the case of regulations that generate new negative externalities or amplify existing ones. This is the case when setting too large minimum limits for single-family residential lots increase housing prices by reducing the supply of land. This dynamic can result in a greater city extension, or even in a growth pattern that produces discontinuities in the urban structure (Mills, 2002).[27]

These regulations are also responsible for the fact that a significant portion of low-income families are kept outside the formal real estate market (see Chapter 4). Rising prices incite families to move far away from employment centers to access formal housing, but this greatly increases their commuting budget. Living in slums in the periphery compensates for the higher transportation costs with lower housing costs. Alternatively, these families could locate themselves in relatively central slum areas, with much higher savings in transportation and housing.

In summary, the conceptual framework presented in this section identifies four main forces that determine the structure and expansion of cities: population growth, income dynamics, mobility infrastructure and technological improvements that reduce the costs of intra-urban travel, and land use regulations. By increasing the demand for housing and its cost, population growth stretches the edges of the city, transforming rural land into urban land. The increase in income promotes a greater consumption of space and favors suburbanization due to the negative price gradient from the CBD towards the periphery. Meanwhile, investment in mobility infrastructure (such as highways) and technological advances that reduce the cost of travel (such as the automobile) also encourage suburbanization. Land use regulations can accompany or limit the urban growth process according to the previously mentioned dynamics.

A fifth factor that determines the form of cities, and which has not been thoroughly analyzed until now, is geography. According to Burchfield et al. (2006), almost one-third of changes in physical size across US metropolitan areas is due to geographic factors. One of the most important is the presence of underground aquifers, which reduce the costs associated with the installation of aqueduct networks because they allow water to be obtained through alternative methods (such as well drilling). Terrain irregularities are also relevant: while relatively low hills lead to dispersal, high mountains act as barriers that favor more compact urban development patterns. This partially explains the fact that cities in the Andean Region of Latin America are relatively less extensive and denser. Consequently, urban development is not only affected by the general dynamics analyzed in this section, but also by a variety of factors associated with local geographical characteristics.

27. In the province of Buenos Aires, in Argentina, there is a regulation which was introduced in 1977 that requires a minimum lot of 300 m2 for single family housing. Clearly, if this regulation is compared with that of other Latin American countries (and even that of developed countries), it is very restrictive.

Urban form and land use in Latin American cities

The conceptual framework proposed in the previous section helps to understand the economic forces that underlie the urban structure and, in particular, to understand the determinants of more or less centralized employment and population structures. This section analyzes the shape of some Latin American cities, as well as the relative importance of the studied forces in determining this structure.

The monocentric model hypothesis and the case of the Metropolitan Area of Buenos Aires

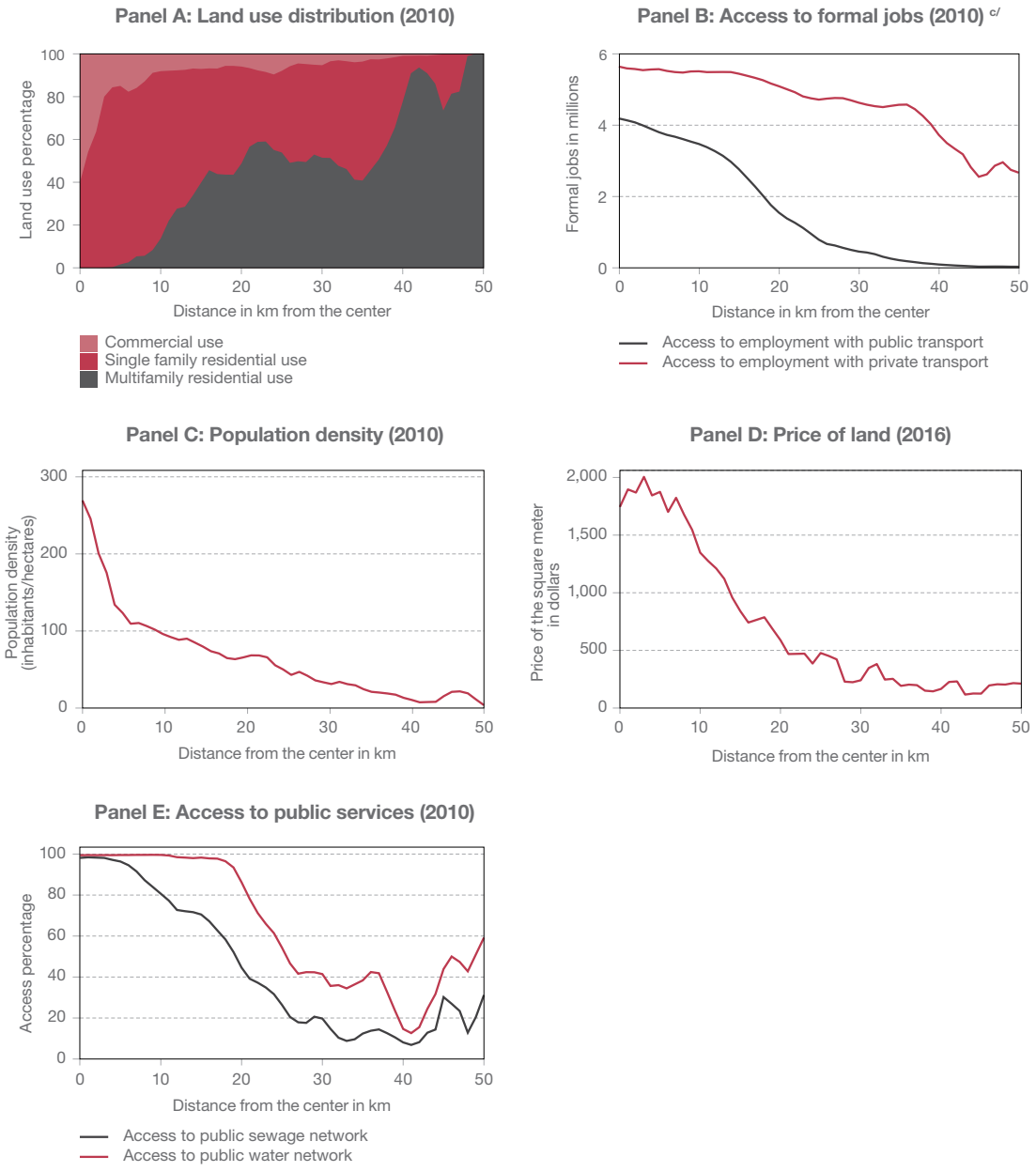
To what extent do the monocentric model's predictions developed in the previous section apply to the internal structure of Latin American cities? Unfortunately, the lack of disaggregated information on employment location, construction and population density, and land prices prevent a comprehensive diagnosis for the entire region. There is only information for a few cities, such as the Metropolitan Area of Buenos Aires. The Center for Research on Urban Policies and Housing (CIPUV, for its acronym in Spanish) of the Torcuato Di Tella University together with the World Bank have produced a database that allows the analysis of some key variables in the city's urban geography.

Graph 2.5 (see p. 90) shows the estimation of curves (gradients) for land use (panel A), access to formal employment (panel B),[28] population density (panel C), land price (panel D) and access to water and sewer services (panel E), from the CBD of Buenos Aires towards the periphery of its metropolitan area. In general, the behavior of all the variables is quite compatible with the monocentric model: near the CBD of Buenos Aires there is a greater proportion of land devoted to business and commercial activities (panel A), which is congruent with the higher density of (access to) jobs observed in that area (panel B). In addition, given the savings in commuting costs that are generated through proximity to labor sources and the competition of commercial land use, the cost of land for residential use reaches its maximum values in this central area (panel D), which is why housing is only available in a multifamily housing modality, producing high levels of population density (panel C). As distance to the CBD increases, commercial and business land use decreases, while residential multifamily and single-family residential land use increase. Also population density and land prices drop.

Beyond these general tendencies, the gradients' behavior does not always maintain a decreasing trend with the same rate. In other words, at certain distances from the CBD, significant changes can be seen in the slopes of the curves, suggesting the existence of subcenters with a certain degree of employment and population concentration. For example, an increase in land use for multifamily housing (panel A) can be detected at 20 km-25 km from the CBD, which partially explains the flattening of the population density curve at that distance from the center (panel C).

28. The access to formal employment variable measures, for a given distance, the number of jobs that households can potentially reach within a maximum transfer time of one hour using public or private transportation.

Graph 2.5 Estimation of gradients for the Metropolitan Area of Buenos Aires [a/ b/]



a/ Estimates arise from averaging the observations of each variable per kilometer. For example, in the case of the density gradient, the population of the census radiuses located at each distance (km) from the center (in all directions) is added up and then divided by the total area of the census radiuses. Then, in a second stage, the curve is tempered through the calculation of moving averages within a 3 km (-1 km to +1 km) window.
b/ In all cases the Congress of the Nation was taken as the center of the city.
c/ The graph shows, in the ordinate axis, the formal workplaces that can be reached within a commute of less than one hour..

Source: Authors' elaboration using data from the National Population, Household and Housing Census of the INDEC (2010), processed with Redatam + Sp, for land use gradients, population density and access to services; Quirós, T.P. and Mehndiratta, S.R. (2015), for the access to employment gradient; and CIPUV-UTDT (2016), for the land prices gradient.

On the other hand, an interesting fact which is highlighted by panel B regarding access to employment is that although the number of jobs that can be reached by traveling one hour or less, in both public and private transport, decreases as the distance to the CBD rises, this fall is much more significant in the case of jobs that can be reached through public transport. This underlines the aforementioned fact that, in general, in many Latin American cities, public transit services are available in central areas and their coverage is substantially reduced in suburban and more peripheral areas. As for the access to employment by private transport, the gradient is fairly flat up to a distance of almost 40 km from the center of the city. This suggests that, in Buenos Aires, automobile use, combined with the highway supply heading south, north and west, has improved access to jobs, which partially explains the great expansion of this city's metropolitan area in recent years.[29] However, not only does access to public transport services diminish significantly in the peripheral areas of the city, but the same occurs with other network services such as water and sewage, as documented in panel E of Graph 2.5.

In many Latin American cities, public transport coverage is substantially reduced in suburban and more peripheral areas.

Employment concentration in Brazilian cities

As has been pointed out, the existence of agglomeration economies implies a tendency towards high employment concentration. Therefore, a central aspect for the study of the internal structure of a city is defining the location of the CBD, which brings together most of the city's economic activity (industrial, services, commercial, etc.). The main difficulty in identifying the CBD in Latin American cities is the lack of good georeferenced information on the location of firms (and on the type of employment they require). In the few cases where such information exists, a second aspect must be resolved, which is to determine a methodology for identifying the location of the CBD and its limits. Some studies use qualitative information (such as historical milestones, official definitions or informed opinions) and then corroborate to what extent these locations have high job densities.[30] Others studies locate the CBD using a quantitative methodology by comparing employment densities at the census radius level (or in smaller spaces when the information allows it) and grouping the contiguous radiuses that stand out with high levels of concentration. The study by García-López and Moreno-Monroy (2016) uses the second methodology to identify the CBD and the main employment subcenters in 35 metropolitan areas in Brazil with more than 500,000 inhabitants. The authors combine the data from the Relación Anual de Informaciones Sociales (RAIS, which constitutes an administrative record of social security) and the location information of firms to

29. The increase in access to jobs at a distance of 50 km-55 km can be explained by the important development of the municipality of Pilar, in the northern suburb of the city of Buenos Aires. Thanks to a successful industrial park (and regulations that inhibits new companies to locate near the center of the city of Buenos Aires), many companies have been moving into this area. The creation of this business subcenter led to an increase in housing around that area, where gated residential neighborhoods abound, as well as commercial and office activities.

30. This methodology, however, is far from perfect. Glaeser and Khan (2004) study the location of employment in 300 metropolitan areas of the United States and find that in only 180 of them the census radius that includes the historical center of the city holds the highest job density.

estimate the employment level of each census radius in each city and, thereby, the concentration of economic activity in that space.[31]

Table 2.2 presents a summary of the estimations of García-López and Moreno-Monroy (2016), dividing cities into three terciles of their population distribution.[32] For each group of cities, different indicators for the distribution and density of formal employment for 2000 and 2010 are shown.

Table 2.2 Employment distribution and densities for selected Brazilian cities in 2000 and 2010 a/ b/

	Group 1	Group 2	Group 3	Total
Population (2010)	676,599	1,136,580	5,462,582	2,475,21
Total employment (2010)	165,879	270,035	1,494,239	657,027
Employment percentage variation (2000-10) %	50	67	38	42
Proportion of employment over population (2010) %	25	24	27	27
Number of subcenters (2000)	1	1	6	3
Number of subcenters (2010)	1	2	9	4
Employment density in the CBD (2010) c/	10,859	18,453	52,933	27,888
Employment density in subcenters (2010) c/	4,487	7,488	13,420	8,579
Average distance of workplaces from the CBD (2010), in km	8.5	22.7	15.0	15.6
Proportion of employment in the CBD (2000) %	24	17	10	17
Proportion of employment in subcenters (2000) %	19	21	40	27
Proportion of employment in the CBD (2010) %	23	22	11	19
Proportion of employment in subcenters (2010) %	21	22	34	26

a/ Employment data corresponds to formal employment.
b/ Group 1 includes cities of up to 500,000 and 850,000 inhabitants; group 2, between approximately 850,000 and 2,000,000 inhabitants, and group 3, with more than 2,000,000 inhabitants. See the Appendix for the complete list of cities.
c/ It refers to the number of jobs per square kilometer.

Source: Authors' elaboration using data from García-López and Moreno-Monroy (2016).Source: Authors' elaboration using data from García-López and Moreno-Monroy (2016).

Several interesting stylized facts emerge from the information provided in Table 2.2. First, the larger the size of the cities, the greater the proportion of formal employment. This is compatible with the idea that agglomeration economies, which partially explain the growth of cities, generate productivity profits that are reflected in the creation of greater quality jobs (O'Clery and Lora, 2016).[33] Second, the CBD concentrates on average a high proportion of urban employment, reaching almost a fifth in 2010. Furthermore, employment

31. In the study by García-López and Moreno-Monroy (2016), employment density is defined as the number of formal jobs per square kilometer.

32. Group 1 includes cities of between 500,000 and 850,000 inhabitants; group 2, between 850,000 and 2,000,000 inhabitants, and group 3, with more than 2,000,000 inhabitants (see the complete list of cities in the chapter's Appendix).

33. This relationship is more significant when larger cities are considered.

density in the CBD grows with the size of the city, even though its share in the city's total employment falls. The latter is because the number of subcenters where economic activity is concentrated increases in larger cities, although the average density in these subcenters is generally significantly lower than that of the CBD. For example, in the case of Sao Paulo, employment density in the CBD in 2010 was almost 158,000 workers per square kilometer, while the average of the city's 33 subcenters was approximately 30,000 workers per square kilometer. Third, employment rises between 2000 and 2010 in most cities (that is, in 19 of 35 cities), as well as the number of subcenters. However, the share of the CBD and subcenters in the city's total employment during this period is relatively constant. Thus, a clear pattern of change in centralization/ decentralization levels cannot be discerned.

In 2010, in Brazil there are very few cities that are strictly "monocentric" (only 3 of 35).[34] This finding could be extrapolated to other cities in Latin America (and developed countries). However, this does not mean that employment shows a strong decentralization pattern, since, as indicated above, employment concentration in the CBD is high and relatively stable, and jobs are relatively close to the center: the average distance indicator is 15.6 km.

An alternative way of evaluating employment concentration and the urban form is through the estimation of curves that describe the spatial evolution of densities, from the center towards the city's periphery (see section "Conceptual framework: Determinants of land use and the internal structure of cities"). Text box 2.1 presents this exercise for a subset of three Brazilian cities. This exercise confirms the previous conclusion regarding the existence of a rather heterogeneous behavior among cities, with cities where employment has decentralized, others where there are no changes, and some in which concentration actually increases.

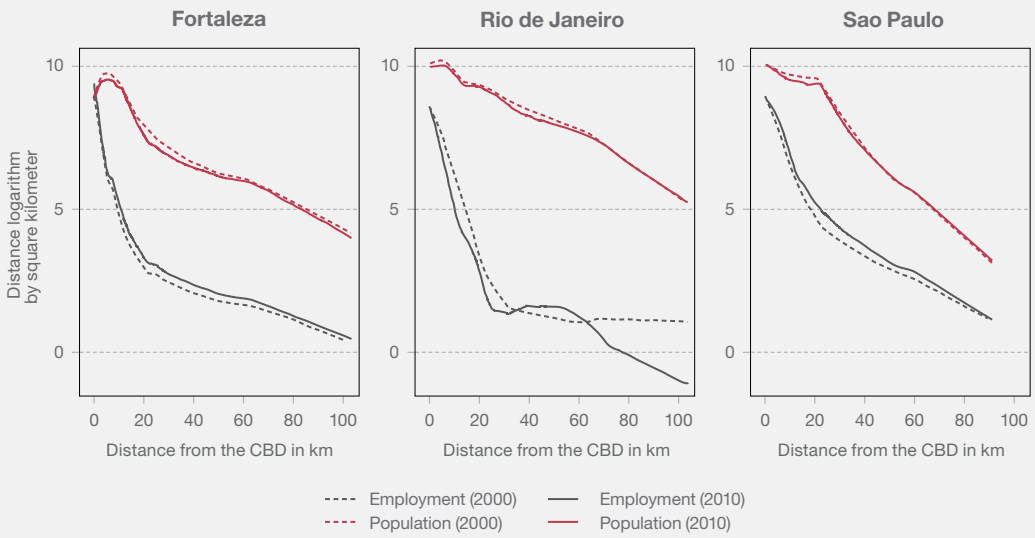
Text box 2.1 The estimation of employment density curves for a selection of Brazilian cities

The estimation of curves (or gradients) that describe the spatial evolution of densities from the center towards the periphery is a widely-used exercise in urban economics literature to evaluate the structure of cities.[a] The monocentric model, described in the conceptual framework, predicts a higher level of employment concentration than residential concentration. Figure 1 confirms this prediction by comparing the employment and population density gradients in three Brazilian cities (Fortaleza, Rio de Janeiro and Sao Paulo) for 2000 and 2010. Indeed, in all cases it is observed that the slope of the curve describing the spatial evolution of employment density is steeper than the slope of the residential density curve.[b] Employment density curves also reflect the existence of subcenters with a concentration of economic activity. The most striking case is that of Rio de Janeiro, where the employment curve has a pronounced break in

34. See the chapter's Appendix.

its slope revealing an increase in employment density at the 30-km mark from the CBD, which suggests the existence of a subcenter that is very important economically.

Graph 1 Employment and population gradients for selected Brazilian cities in 2000 and 2010 a/



a/ The graph shows the estimation of employment and population density as a function of distance from the CBD, using the nonparametric method of Local Regression (Logically Weighted Regression), for the cities of Fortaleza, Rio de Janeiro and Sao Paulo, in 2000 and 2010.

Source: García-López y Moreno-Monroy, based on García-López and Moreno-Monroy (2016)

Table 1 Employment and population gradients for selected Brazilian cities in 2000 and 2010 a/ b/

Fortaleza				
	Employment density		Population Density	
Years	2000	2010	2000	2010
Logarithm of the density in the CBD	6.019***	6.332***	9.591***	9.687***
	(0.047)	(0.05)	(0,042)	(0.033)
Density gradient	-0.088***	-0.089***	-0.049***	-0.068***
	(0.002)	(0.002)	(0.004)	(0.002)
Adjusted R^2	0.3	0.27	0.16	0.3
Rio de Janeiro				
	Employment density		Population Density	
Years	2000	2010	2000	2010
Logarithm of the density in the CBD	6.646***	5.461***	10.385***	8.539***
	(0.044)	(0.052)	(0.027)	(0.068)
Density gradient	-0.084***	-0.101***	-0.046***	-0.015***
	(0.002)	(0.002)	(0.001)	(0.002)
Adjusted R^2	0.15	0.16	0.15	0.15

Continued ›

Sao Paulo				
	Employment density		Population Density	
Years	2000	2010	2000	2010
Logarithm of the density in the CBD	7.603***	7.958***	10.065***	9.172***
	(0.033)	(0.033)	(0.023)	(0.041)
Density gradient	-0.128***	-0.124***	-0.038***	-0.022***
	(0.002)	(0.002)	(0.001)	(0.002)
Adjusted R^2	0.18	0.17	0.05	0.09

a/ The table shows the coefficients estimated by ordinary least squares. The dependent variable is the logarithm of employment and population density, and the independent variable is the distance from the CBD in kilometers.
b/ Robust standard errors in parentheses. *, ** and *** indicate statistical significance at 1%, 5% and 10%, respectively.

Source: García-López and Moreno-Monroy (2016).

The comparison of the econometric estimations of the employment and population density gradients for 2000 and 2010 (see Table 1) allows us to evaluate the changes in the urban form during this period. The results show that, during this period, all three considered cities experienced growth in formal employment densities. In the case of Fortaleza, growth is widespread throughout the city, with increasing central and peripheral densities in equal proportions.[c] This means that there was no significant change in the employment distribution across the city's geography. In the case of Sao Paulo, growth is decentralized, since peripheral densities increase proportionally more than central ones (the curve becomes flatter). Finally, Rio de Janeiro is part of a centralized growth process in formal employment, showing an increase in central densities and a reduction in peripheral ones (the curve becomes steeper in 2010 compared to a decade earlier). As a consequence, the city has become more monocentric in terms of employment concentration.

As for the population density, results show that in the first decade of this century Rio de Janeiro and Sao Paulo experienced a suburbanization process with decreasing central densities and an increase in peripheral ones (the curve flattens) while in Fortaleza the opposite phenomenon is observed.

In conclusion, the analysis of these three cases suggests that, potentially, there is a high degree of heterogeneity, at least in the case of Brazil, in the evolution of the urban structure that accompanies the city's growth in terms of employment and population. This highlights the need to study the evolution of urban structure on a case-by-case basis, evaluating the relevance of possible determinants and the consequences for urban public policies.

a. See, for example, Bertaud and Malpezzi (2003, 2014) and Bertaud (2004).
b. This result is corroborated by the econometric estimation of the slopes presented in Table 1.
c. The curve moves upwards in a parallel manner: the estimated coefficient of the constant rises and that of the slope remains constant

Patterns of population decentralization in cities in Latin America, the United States and Europe

Job location is a fundamental determinant in the residential decisions of families. That is why an urban structure where jobs are highly concentrated

In general, cities in the United States show higher levels of decentralization of the urban population than those of Latin America and Europe.

in a few locations, may induce a strong concentration of the population to avoid commuting costs. This implies high housing prices and a lower consumption of residential space. However, as indicated in the conceptual framework, factors such as increasing family incomes, improvements in access to mortgage loans, investments in public transport networks (e.g. suburban train network) and the technological changes associated with cheaper car use can drive suburbanization processes. In such a case, a much more decentralized residential distribution can be observed compared to employment (see Text box 2.1, page 93).

This subsection studies population decentralization processes in more detail. For this purpose, CAF's Database on the Extension of Metropolitan Areas (BEAM by its acronym in Spanish), described in Chapter 1, is used to analyze the population's share living in the cities' central areas and compare it with that of the remaining urban area.[35] This analysis is presented in Table 2.3, where "central area" is defined as the urban space within a 5 or 10 km radius around the city's central point.[36]

In general, cities in the United States show higher levels of decentralization of the urban population than those of Latin America and Europe. If the center is considered as an area of up to 5 km around each city's central point, all considered cities in the United States have less than 10% of their inhabitants residing in this central area, both in 2000 and in 2010. In cities like Madrid and Rome, however, this percentage is 22% and 28%, respectively, in 2010, while in Caracas that same year it reached 37%. Only Buenos Aires and Mexico City are below 10% in Latin America, and London, in Europe.

If the center is considered as the area within a 10 km radius around the city's central point, population concentration in this zone does not exceed 14% in the United States (except New York, where it almost reaches 20%), and reaches values as high as 58% in Rome and 55% in Madrid for 2010. According to this definition, the percentage of urban inhabitants living in central areas in Latin America in all cases exceeds 50% in 2010, except in Buenos Aires (19%) and Mexico City (26%). The fact that metropolises located in Andean countries exhibit this pattern is unsurprising, given the restrictions that geographical accidents impose on urban expansion.

35. In Ch et al. (2017) details regarding BEAM are described.

36. In note b/ of Table 2.3 the geographical reference point which was used as the center for each city is indicated. It was generally chosen in regard to an administrative/political landmark (for example, the seat of government).

Table 2.3 Changes in population density patterns during 2000-10 for selected cities in North America, Europe and Latin America [a/ b/]

			5 km distance from city center			10 km distance from city center		
City	**Population (2000)**	**Population (2010)**	**Population in central area (2000) %**	**Population in central area (2010) %**	**Difference between 2000 and 2010 in p.p.**	**Population in central area (2000) %**	**Population in central area (2010) %**	**Difference between 2000 and 2010 in p.p.**
North America								
Atlanta	2,981,331	4,527,711	5.5	6.5	1.0	15.5	13.4	-2.1
Chicago	8,336,630	10,623,020	3.0	5.7	2.7	13.0	12.4	-0.6
Los Angeles	13,289,918	15,803,291	4.1	4.2	0.1	13.6	11.5	-2.0
New York	15,613,956	15,598,063	7.3	9.8	2.5	19.7	19.5	-0.3
Europe								
London	9,501,808	12,132,310	7.8	7.9	0.1	25.0	24.2	-0.8
Madrid	4,439,990	5,525,552	31.6	22.3	-9.3	75.2	54.7	-20.5
Paris	9,575,634	10,552,397	15.8	17.9	2.0	39.9	40.4	0.6
Rome	3,240,829	3,398,718	33.1	28.1	-5.1	75.5	57.6	-18.0
Latin America								
Bogota	5,781,236	7,717,989	20.3	18.2	-2.0	61.6	53.7	-7.9
Buenos Aires	10,757,883	14,127,009	10.3	7.0	-3.2	23.4	18.9	-4.5
Caracas	4,078,695	3,821,912	42.5	37.0	-5.5	81.9	66.6	-15.2
Lima	7,254,642	8,836,417	25.5	33.1	7.7	68.0	74.0	6.0
Mexico City	16,428,409	20,529,656	9.3	7.5	-1.8	30.4	26.1	-4.3
Montevideo	1,416,941	1,604,885	25.0	24.0	-1.0	72.0	67.8	-4.3
Quito	941,117	2,031,086	37.7	26.6	-11.1	85.8	60.3	-25.5
Santiago de Chile	5,015,025	5,897,845	23.4	16.4	-7.0	64.8	51.0	-13.8

a/ The table shows the percentage of population within a radius of 5 km and 10 km from the geographical center of the city compared to the total population for 2000 and 2010.
b/ The following geographical references were considered for each city. For Latin America: Bogota (Bolivar Square), Buenos Aires (Obelisk), Caracas (Bolivar Square), Lima (Mayor Square), Mexico City (Zocalo), Montevideo (Intendencia), Quito (Alcaldia) and Santiago de Chile (La Moneda Palace). For Europe: London (Charles Statue), Madrid (Mayor Square), Paris (Notre Dame) and Rome (Republic Square). For North America, the references are US cities: Atlanta (Atlanta Central Library), Chicago (Cloud Gate), Los Angeles (Pershing S quare) and New York (Times Square).

Source: Authors' elaboration based on BEAM (CAF, 2016), Ch et al. (2017) and population data from Landsat 8 (USGS - NASA, 2010).

Lima has a strongly monocentric structure, while Mexico City has a more decentralized pattern, with multiple subcenters distributed across its geography.

When comparing the data for 2000 and 2010, Table 2.3 (see p. 97) also suggests that for most cities analyzed there has been a process of decentralization of the population, particularly when considering the area covered by a 10 km radius from the central point of the city.[37] The case of Quito, in Latin America, is worth noting as we observe a reduction in the share of population living in the center (defined by a 10 km radius) from 86% in 2000 to 60% in 2010. Caracas and Santiago de Chile also show substantial declines (around 14 percentage points). According to the most restrictive definition of central area, which considers a radius of 5 km, Latin American cities continue to undergo a process of decentralization. This contrasts with cities in the United States, London and Paris, where these zones are gaining a share of the total urban population. This phenomenon is partly associated with interventions that have sought to revitalize the historic center of these cities by promoting a mixed land use (both commercial and residential).[38]

A complementary approach to evaluating population distribution within cites is through "thermal mapping", which describes urban population density in two dimensions.[39] Graph 2.6 illustrates this representation for some of the previously studied cities: Bogota, Mexico City and Lima for Latin America; Chicago in the United States and Madrid and Paris in Europe. The maps show the circles representing a circular area of 5 and 10 km radiuses from the city center (as well as other projections with 10 km increments). For each city two panels are shown: to the left density distribution within a 30 km radius from the city center. The color intensity in the maps is directly proportional to density level. The panels to the right capture the complete city boundaries, as estimated by BEAM according to the methodology laid out in Chapter 1, for 2000 and 2010.

A city's shape can be evaluated through the representation of density levels. Examples for Latin America as exhibited in Graph 2.6 show a variety of situations. First there is Lima with a strongly monocentric structure, comprised of a central area with population density levels of up to 60,000 inhabitants per square meter in some segments (approximately 600 inhabitants per hectare). Second, in Bogota, a clear subcenter appears to the southwest in addition to the central business district (CBD).[40] Finally, Mexico City presents a higher decentralization pattern with multiple subcenters distributed throughout the city's geography. In contrast to the heterogeneity of the region, Madrid and Paris show a clearly monocentric structure, with density dropping sharply beyond the central area (defined as an area spanning a 10 km radius from the center). At the other end of the spectrum, in US cities such as Chicago, density distribution is more homogeneous throughout the territory.

---

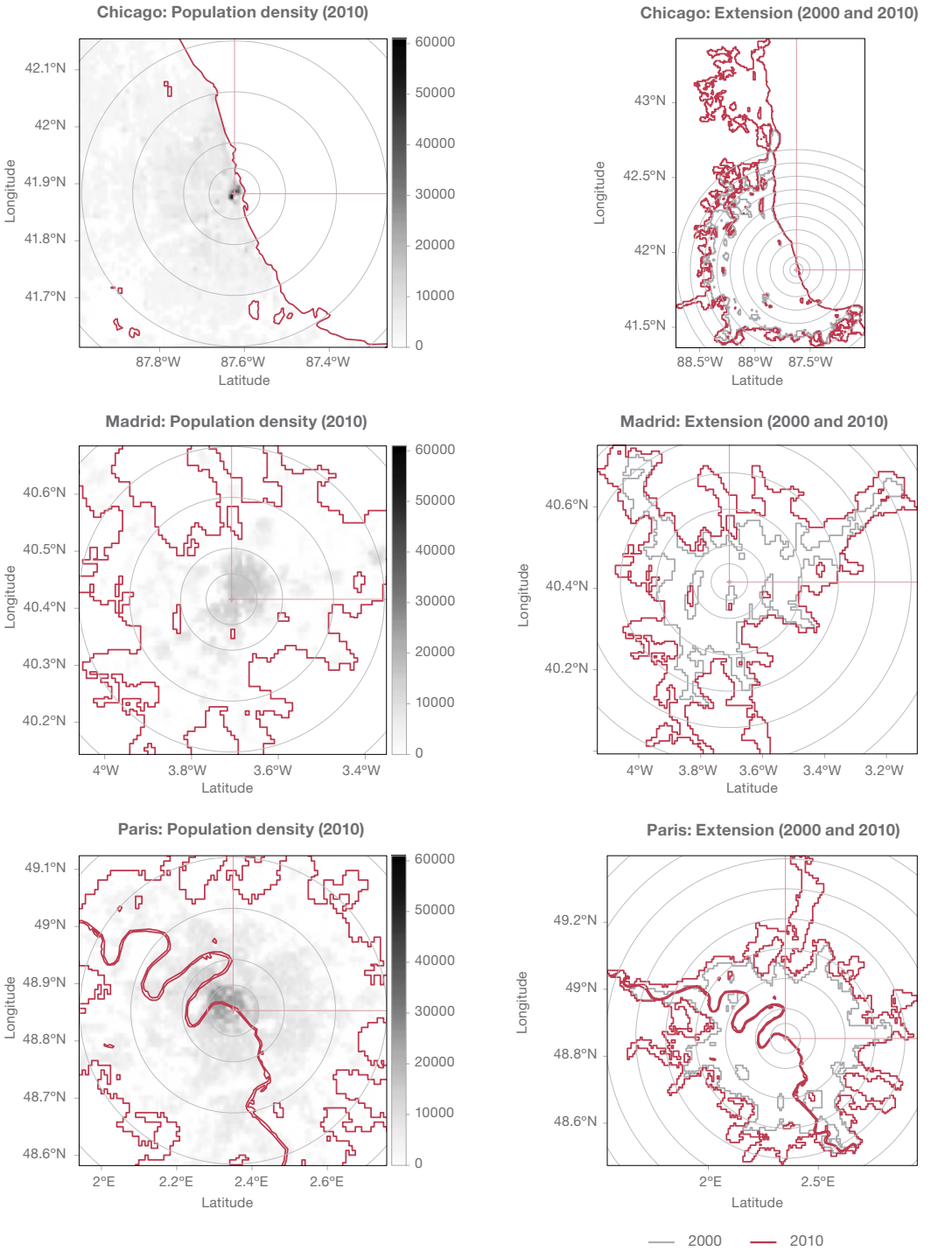
37. With Lima being the sole exception, showing a process of increased concentration both within the 5 km and the 10 km radius.

38. Redevelopment of vacant industrial buildings in central locations (brownfield development) is an active policy in most of these cities. This topic is developed in more detail in the section "Land use regulation and urban growth".

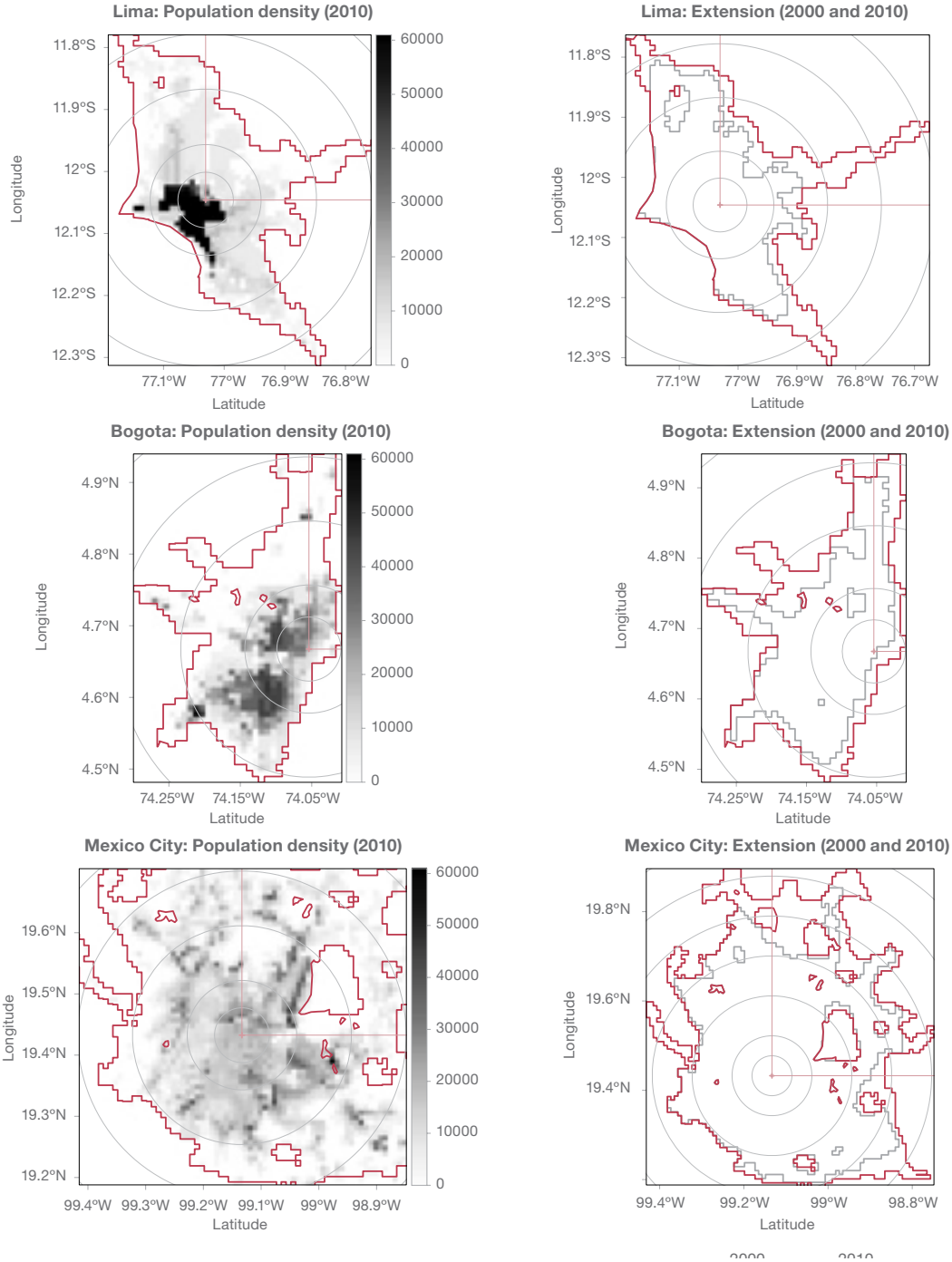
39. Population information is disaggregated into 1 km^2 segments (Ch et al., 2017).

40. Bogota's CBD overlaps with the financial district, with epicenter on Calle 72 and Carrera 7ª. The subcenter located to the southeast corresponds to the so-called "international center", which runs from Calle 32 to Calle 19.

Graph 2.6 Population density and extension for selected cities in the United States, Europe and Latin America [a/]



Continued ›



a/ The left-hand graphs identify the population density per square kilometer for 2010, using georeferenced population as estimated by Landsat 8 (USGS - NASA, 2010). The right-hand graphs identify the limits of urban extension for 2000 (grey) and 2010 (red). The following geographical references were considered for each city: Bogota (Zona T), Lima (Plaza Mayor), Mexico City (Zocalo), Chicago (Cloud Gate), Madrid (Plaza Mayor) and Paris (Notre Dame). Both for the population density graphs and for the extension graphs, the circles centered on the geographical centers mentioned above have a 5 km radius followed by a 10 km radius, with subsequent 10 km increments (i.e. they go from 10 km to 20 km, 30 km, 40 km and so on). The cities' latitude and longitude in degrees are included for geographical reference.

Source: Authors' elaboration based on BEAM (CAF, 2016), Ch et al. (2017) and population data from Landsat 8 (USGS - NASA, 2010).

A noteworthy fact illustrated in Graph 2.6 (see p. 99) is the contrast of the urban expansion of Latin American cities when compared with their European and especially with their US counterparts. This phenomenon has already been pointed out in Chapter 1 and in the section "A comparative perspective of growth and land use dynamics in Latin American cities" of this chapter. In Lima and Bogota, for example, a radius of 20 km from the city center encompasses a considerable area of the city (on average, no less than 70%), and there is no significant growth of the urban area extension for these two cities between 2000 and 2010. Mexico City, meanwhile, stands out within the region for its relatively wide extension (along with Buenos Aires and Sao Paulo), with suburban areas that can be identified even at a distance of 40 km from the center. The extension of Mexico City and Buenos Aires are comparable to certain European cities such as Madrid and Paris, which show important suburban developments 50 km away from the center, some of which have consolidated during the last 10 years (Madrid to the South and Paris to the North). Chicago, in the United States, is a classic example of a city with extended suburban areas, which in some directions reaching as far out as 60 km from the city center.

Slum incidence has increased in the last few years, with few examples of reconversion and integration of these neighborhoods into the formal urban structure.

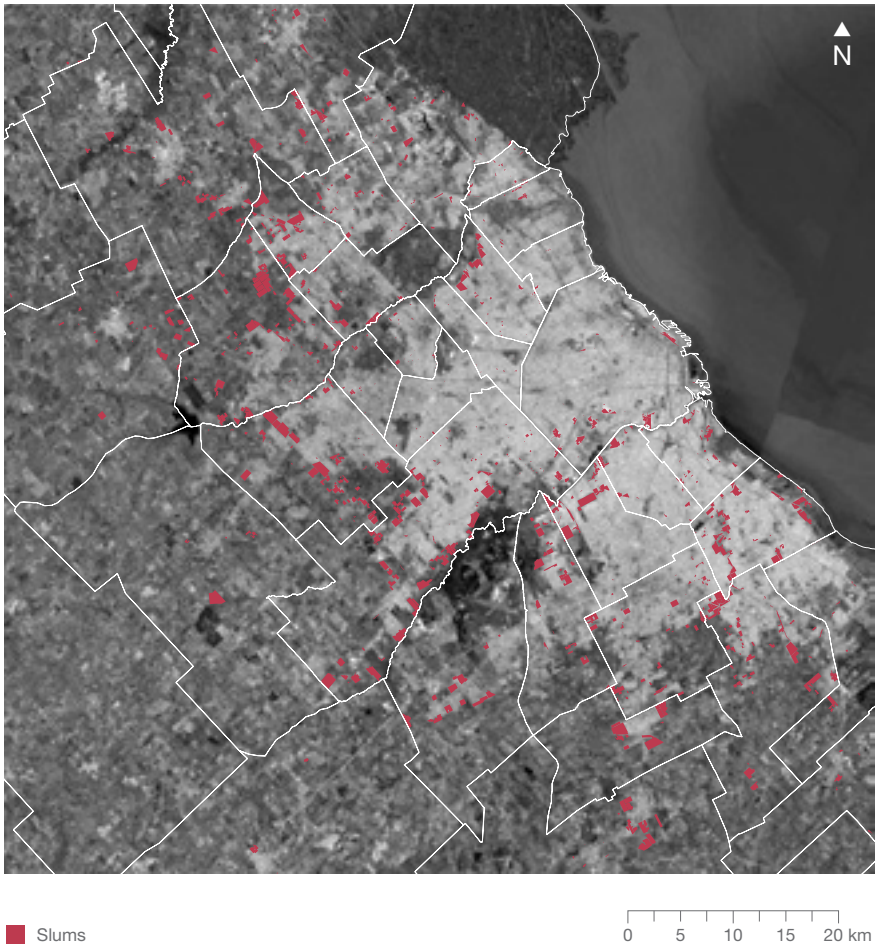
Distribution of slums in urban geography: The case of the Metropolitan Area of Buenos Aires

As mentioned earlier, Latin American cities (as well as cities from other developing countries) are characterized by a high level of informality, reflected in the coexistence of formal urban developments and slums, where low-income families occupy land that is generally government property. This type of dwelling constitutes a "solution" to the problem of housing for many families, allowing them access to better jobs (and services such as education and health) than those available in their place of origin, without having to pay for the elevated market value of formal housing (see Chapter 4). Slum incidence has increased in the last few years, with few examples of reconversion and integration of these neighborhoods into the formal urban structure despite government efforts to change this reality.[41]

Analysis of the location, size, dynamics and other aspects related to slums in Latin America faces the problem of lack of systematic and reliable information. The recent availability of data from satellite photos has allowed for partial progress in the quantification of this phenomenon for some cities (Duque et al., 2016). Graph 2.7 (see p. 102) shows the case of the Metropolitan Area of Buenos Aires, based on the survey of slums made by the Techo Argentina Foundation in 2016 (Techo, 2016). The graph shows how these neighborhoods are distributed throughout the entire urban geography, including very central areas. The so-called "Villa 31", for example, with an estimated population of over 30,000 people and a density of 800 inhabitants per hectare, is located very close to the Buenos Aires CBD.

41. Henderson et al. (2016) analyzes the case of Africa, mentioning how institutional failures affect slums reconversion in the continent's cities.

Graph 2.7 Location of slums in the Metropolitan Area of Buenos Aires in 2016 a/



a/ A slum is defined as a group of at least eight grouped or contiguous families, where more than half does not have property title nor regular access to at least two of the basic services: tap water, electricity with home meter, and/or excreta disposal through the sewage network. The survey was carried out on-site, detecting slums and interviewing community representatives/key informants.

Source: Slums survey (Techo, 2016).

The job concentration in the central area provides advantages to those workers (in many cases informal) living in the slums located near the CBD. These advantages include minimization of transportation costs and accessibility advantages, not only to potential jobs but also to other services. This explains the higher market value of land and housing in centrally located slums, as well as their higher population density, which usually is comparatively higher than that of the formal city neighborhoods. The slums that sprout in the urban periphery, where land is cheaper, are in

contrast lower in density, with little to no infrastructure and even of poor environmental quality, such as river banks or floodplains unsuitable for urbanization. The process of slum proliferation in peripheral urban areas can contribute, as we will see in the next subsection, to a greater degree of urban segregation.

When coupled with the suburbanization of high-income households, urban expansion can contribute to the process of segregation.

Urban growth and segregation: Evidence for the Metropolitan Area of Buenos Aires

As mentioned in the conceptual framework, land value varies within a city as a function of its distance from the city's CBD, transportation costs and the presence of amenities. This phenomenon, coupled with the fact that families have varying income levels, can potentially lead to a process of segregation by income level. However, the specifics of urban segregation can take a variety of forms. For example, depending on the circumstances, wealthier families tend to locate in suburban areas or near the areas central to economic activity. As mentioned earlier, the same can be said of slums. The specifics of urban segregation are particularly relevant in relatively monocentric cities, as tends to be the case in Latin America. Housing segregation is in fact particularly problematic when employment opportunities are concentrated in one part of the city, since it reduces accessibility[42].

When coupled with the suburbanization of high-income households, urban expansion can contribute to the process of segregation, based on, for example, the demand for more space or fiscal incentives. This process encourages the creation of gated communities, with private security, green space and sports facilities. Thus, in the Metropolitan Area of Buenos Aires, 10% of the land that is zoned for urban use is destined to this type of urbanization, and in municipalities such as Tigre, 34% of the area is destined to private developments or country clubs (Goytia et al., 2015a).

Goytia and Dorna (2016) analyze the relationship between urban growth during the years 2000-10 and household socioeconomic segregation in the 31 Argentine metropolitan areas. The results confirm that low-income household segregation prevails in most metropolitan areas. Evidence also suggests that different urban growth patterns have various effects on segregation. Discontinuous growth is the biggest culprit of segregation, particularly of the poorest. One could explain this phenomenon by the location of social housing projects in peripheral areas removed from the cities, where land is cheaper and there is precarious access to basic services and transportation

42. Garrido and Vargas (2016) argue that as long as unskilled workers cannot access jobs in the city and there are complementarities between low and high-skilled workers, segregation will have negative effects on the city's aggregated productivity. If, however, urban activity is concentrated in productive hubs with no such complements, spatial concentration of skilled workers will lead to positive externalities what will compensate for the productivity losses associated with unskilled workers. The city's productivity will in this case be unaffected by segregation.

networks. In contrast, cities that grow by extension and through filling up open space within the urban borders result in a lower degree of segregation of the lower-income households, which are consequently distributed more homogeneously across the urban territory.

Land use regulation and urban growth

In most countries and cities in the world, land use and urban structure are not the result of the action of market forces alone. Territorial planning systems (such as urban codes) lay down regulations that condition land use, urban structure and growth possibilities. This section analyzes the impact of land use planning and its regulation.

Zoning and land use regulation: Background and purpose

Land use regulation and planning, or in other words, territorial organization through zoning and other measures that condition land use, are a common mechanism for controlling the externalities associated to certain land uses (such as industrial activities). In this sense, planning establishes requirements on lot size and buildings height, seeks to ensure adequate solar lighting conditions and determines the amount (and variety) of amenities in each urban area (through establishing not only the amount of public open space and parks but also the proportion of free areas in each plot). Regulation also determines the requirements that private developers must meet as contribution to public infrastructure, such as space destined for circulation routes and public equipment, or connections to water and sanitary networks. Potential benefits to urban territorial planning include the provision of public goods such as public spaces for roads or parks, or the safeguarding of environmentally protected areas. This is important, since public space would likely be underprovided by the market, calling for regulation on this matter. Finally, another group of regulations defines the minimum standards for construction quality and living conditions, together with the inspection regime.

Duranton (2007) conducts a taxonomical study of the origin of regulations depending on the type of public institution or, alternatively, private interest that promotes their establishment. A first approach indicates that zoning regulations are implemented in municipalities (that is, at the sub-metropolitan level) driven by benevolent local planners who seek to maximize local wellbeing. In this case, zoning regulations will be efficient, as long as the externalities they seek to correct occur exclusively in their jurisdiction. When externalities are not restricted to the municipal limits, a lack of municipal coordination will most likely promote suboptimal situations (for a more detailed discussion, see Chapter 5). The requirement of a minimum lot size in a neighborhood can, for example,

promote air quality, safety and property value, but can also negatively impact other territories as the unsatisfied housing demand will shift to other areas of the city, most likely increasing urban congestion in those zones. In the second approach, a body responsible for coordinating this regulatory role implements zoning regulations for the entire metropolitan area. Although this approach would appear more efficient than the first, by encompassing all externalities and the spillovers generated amongst municipalities within the metropolitan area, there are still very few cities in the region that adopt coordination mechanisms for land use planning (see Chapter 5). This could partly account for the inefficient expansion of some Latin American cities, especially those characterized by high administrative fragmentation (Lanfranchi and Bidart, 2016).

Land use limitations for urban development increase the price of land and, therefore, of housing.

The third approach recognizes that in many cases and particularly in developing countries, regulation is not justified in terms of correcting externalities but is rather associated to fiscal motivations or economic interests of certain groups. Zoning regulation, for example, can be the result of a process of local decision-making that, by restricting new developments, benefits local residents by increasing the value of their property. Fischel (2001) coins the term homevoters to describe homeowners who vote (or lobby) regulations that preserve or increase the value of their property, even to the detriment of general wellbeing. Many cities offer mechanisms for engaging citizen participation and public consultation with community members to carry out local zoning. This is the case in 60% of Argentine municipalities (Goytia et al., 2010). Although this kind of mechanism can be considered a form of direct democracy, it also encourages owners to promote more restrictive measures (Fischel, 1980, 1985; Quigley, 2007).

Opposition to new housing developments in many urban neighborhoods could be an indicator of this type of inefficiency, originated in the political economy of regulation. This is also the case with regulations that establish very high minimum requirements for lot size and strict limitations on developments. This type of initiative, which often seeks to mitigate the cost of urban congestion (caused by traffic, for example) by capping urban growth, discourages investment in housing and promotes social exclusion by increasing land prices. A paper by Combes et al. (2016) on French cities suggests that those cities that allow the extension of the urban area to adjust to population growth ultimately succeed in keeping the price of land under control. The authors demonstrate that the costs of a bigger city (requiring bigger investment in infrastructure) are modest and of the same magnitude as the gains in agglomeration economies, leaving no support to the imposition of development regulations which favor a strict restriction on urban extension growth.

Land use limitations for urban development increase the price of land and, therefore, of housing. Consequently, households and firms reduce their consumption of space. Resisting urban expansion could, therefore, result in denser cities, with smaller housing and more expensive land (Brueckner, 2001), but also with fewer firms, less capacity to attract workforce and lower productivity (Duranton and Puga, 2001). In conclusion, the social cost of restrictive zoning can be quite high.

There is an important variation in the way cities regulate land use within the region.

This evidence flags a warning on policies being applied in Latin America with the objective of restricting the growth of urban extension. Although there may be legitimate reasons to avoid a disorganized and discontinuous growth (without accompanying infrastructure) of the urban border, these restrictions could increase congestion costs and house prices. In Mexico City, for example, the construction of social housing has led, since the early 1990s, to a sustained urban growth in scattered areas located at great distance from the city center. By fostering residential developments in remote areas, with little accessibility to employment hubs, lack of coverage for basic services and inadequate mobility infrastructure, this process has generated major inefficiencies.[43] As a way of counteracting this phenomenon, the Mexican federal government recently launched the promotion, through the Plan Nacional de Desarrollo 2013-18 (National Development Plan) and the Programa Nacional de Desarrollo Urbano 2014-18 (National Program for Urban Development) of an urban policy agenda to contain extensive urban growth through the establishment of urban perimeters. Although this policy could be a justifiable response to the bad experience resulting from the social housing policy, these limits could eventually become restrictive by excessively driving up housing prices and congestion within the city. This could happen particularly if the economic and market conditions change, favoring the decentralization of employment and population.

Land use regulation in Latin American cities

There is an important variation in the way cities regulate land use within the region. This variability is partly due to the faculties that the high government levels in each country delegate to local administrations. But it is also a function of the instruments and capacities conferred to these local governments. Regrettably there is a lack of systematized and comparable information on the different characteristics of these regulatory frameworks for a large sample of Latin American cities.

The CIPUV Land Policy Index (CILP) is the most comprehensive action yet performed in a Latin American country to measure the regulatory environment at the municipal level (Goytia et al., 2012). Based on a survey targeted at the Directors of Planning for Argentine municipalities, this indicator provides a standardized measure that summarizes the conditions of the local regulatory environment, facilitating the comparison between jurisdictions. The index reproduces the methodology of the Wharton Residential Land Use Regulatory Index developed by Gyourko et al. (2008) and incorporates aspects specific to the problems relevant to Latin American cities: informality of the land and housing market, and weak enforcement of land use regulation compared to developed countries.

43. As a direct result of the suboptimal location of these social housing projects built with the financial support of the Instituto del Fondo Nacional de la Vivienda para los Trabajadores, roughly 390.000 to 487.000 housing units built between 2006 and 2010 are currently uninhabited (OECD, 2015).

This aggregated index comprises several subindexes with information that includes data on the existence of urban codes, the process and costs required for project approval, the characteristics of the provision and financing of infrastructure services, zoning and construction regulation, the existence of citizen participation mechanisms in defining regulations, and the application of instruments to recover the additional value generated by urbanization and public investment.

Results show that land use regulation is mostly heterogeneous across Argentine territory, presenting substantial differences amongst metropolitan areas, amongst the municipalities that compose them and between jurisdictions located within metropolitan areas and outside them. To illustrate the point: 95% of the municipalities in the metropolitan areas have local ordinances regulating land use, but only 73% have actually defined a code for land use. It is also interesting to analyze the extent to which the regulations are up to date. According to the index, the most updated ordinances belong either to the largest municipalities or those most densely populated. Low-density municipalities are, in average, more prone to have outdated land use regulation instruments when compared with medium- and high-density municipalities. As for the enforcement of local regulations, 63% of highly regulated jurisdictions (those with above-average CILP) report low levels of enforcement.

The municipalities of the Pampean region (center-east part of Argentina) and its large metropolitan areas, including Bahia Blanca, Buenos Aires and La Plata exhibit the most rigorous regulatory environment, with the Metropolitan Area of Buenos Aires being the most restrictive countrywide. The biggest differences between highly regulated and less regulated environments occur in terms of costs, project approval times, and public-sector participation in financing urban infrastructure. Jurisdictions with a higher level of regulation generally have two levels of regulation (local and provincial) and require the participation of more authorities to approve regular projects and zoning modifications.

Variations at intrametropolitan level suggest that municipalities with over 50,000 inhabitants, which form the peripheral ring around the main metropolitan areas, present the most stringent indicators with respect to various CILP components. In these municipalities, with relatively large vacant areas (as a percentage of total area) and a relatively lower density, there is less public financing of infrastructure expansion (as a percentage of total financing).

Interventions that incease city value: Renovation of deteriorated and underutilized areas

The presence of deteriorated or underutilized areas in the city center is, to different degrees, one of the shared characteristics amongst Latin American cities. As in many cities in developed countries, new standards in production, transportation and logistics stemming from new technologies and economic transformation have left a large number of empty warehouses, old train stations and industrial and port complexes in central areas of the cities underutilized or degraded. In other words, because constructions are very durable goods, the “creative destruction”

of economic development implies transformations and displacements that leave behind ample unoccupied spaces within cities (Duranton, 2007).

With the shift of economic activities and the associated implications for land use and value, new suburban areas compete with the old buildings of the central city for urban residents. As the older buildings require greater investment in maintenance, and the market tends to favor suburban locations, the combined factors could lead to an excessive development in extension, punishing the market value of property located in the city center and further undermining the incentives for its maintenance.

Systematic evidence on the amount of vacant or underutilized land in Latin American cities is very scarce, so building a database that accounts for this phenomenon should be a public policy priority. Currently it is only possible to base the discussion on specific urban experiences in the region, covering several types of interventions according to the specific problems they face. On one hand, there are programs for the recovery of deteriorated areas of historic importance, such as the recovery of Quito's Historic Center, in an attempt to turn around the tendency towards obsolescence and decline of these areas through the creation of new cultural amenities with heritage value.

There are other interventions that seek to harness development opportunities offered by railway or logistic infrastructure located in zones that have become urbanized. Exponents of this category can be found in renovated docking areas, airports, railway stations and other facilities that have lost their original vitality and purpose. These interventions aim to recycle these areas for complementary purposes, such as residential or commercial use and also for offices. Two iconic cases are the zone of Puerto Madero, in Buenos Aires, and the more recent Porto Maravilha, in Rio de Janeiro, which followed the steps of the London Docklands renovation. They stem from riverside docks and facilities located in the city center that fell into disuse, and both share the implementation of similar strategies of recuperation. These include an autarchic management institution that overcomes the coordination difficulties that usually plague intervention of this type, when the renovation is promoted by public and private partnerships. The defined land use regulations in these cases is also similar: mixed land use programs in which a services sector coexists with a large housing component, as well as equipment and services oriented to a young population with good urban connectivity.

A third type of intervention aims to modify the city's growth trend, focusing on repopulating underutilized sectors within the city through granting subsidies (for purchase or rent) and credit to promote the development of social housing. Examples of this kind of intervention can be found in the city center of Sao Paulo and the southern part of the city of Buenos Aires, and in the repopulation of the Barrio Poniente of Santiago de Chile.

Finally, with the purpose of discouraging large urban spaces of vacant land in urbanized areas, Bogota and some municipalities in the province of Buenos Aires, Argentina, to name some examples, specifically tax ownership of vacant lots in certain central areas.

Green space and its location

Green areas are highly valued when localized in densely populated areas.

The loss of open space to urban growth is an undesirable consequence of urban expansion. Faced with this reality, planners may feel the temptation to maintain green areas on the city perimeter. There is no evidence, however, that households value open spaces when located on the cities' periphery. In fact, green areas are highly valued when located in densely populated areas (Turner, 2005). The promotion of open spaces in the urban perimeter and the concept of green belts potentially increase the stress on the already densely populated central areas, when the actual necessity is to allocate green spaces within the central and suburban areas.

A wide range of empirical work has analyzed how households assign value to different types of green spaces. Open spaces provide positive externalities (amenities) in highly developed urban areas and negative ones (such as longer commute time) in areas that are not highly developed (Walsh, 2007). When choosing housing, families value the proximity to public parks, open space and private property gardens. Indeed, the evidence suggests that housing prices decline with distance to parks. However, the relationship between open space and price is not linear: beyond a 1 km distance, the price of housing decreases as a function of proximity to parks and open spaces, since it generally competes with the proximity to other complementary urban benefits, such as shops and other services that are sometimes valued higher than access to open space.

Open space is, therefore, a local public good, whose improvement in terms of quality, integration and maintenance will have positive social and economic impact. In terms of social impact it is worthwhile to mention the increase in household wellbeing, public health benefits and environmental benefits derived from improvements in air quality, and the mitigation of high climatic variations. Regarding economic impacts, a key factor is the appreciation of the properties that adjoin the green spaces. The inclusion of green space has the additional potential to revitalize high-density slums.

Financing instruments based on land revaluation

Public investment (in infrastructure or green space, to name a few) and regulations governing land use affect land and property value. These changes capitalized in property value can provide a potential source of income to finance the necessary investments required for urban development. However, this potential for generating fiscal resources, generically referred to as land based financial instruments is mostly untapped in the region. This contrasts with experiences in cities from developed countries, such as the UK betterments or the US windfalls. The few cases available in Latin America are based on local regulation or in regulations from higher government levels. An iconic case in the region is the great amount of urban renovation projects in Sao Paulo financed by the issuance of Certificate of Additional Building Potential (CEPAC) which are actioned through the Sao Paulo Stock Exchange.

The resulting revenues are invested to finance the entire infrastructure required by the project in the urban area where it operates.

Another innovative land policy instrument which allows municipalities to have the resources to plan and guide expansion is to readjust land plots, bringing about public-private participation by forcing landowners to share the costs of extending mobility and services infrastructure in suburban areas. In exchange for giving up a part of their land for streets and networks, landowners receive an urbanized plot (equipped with basic services and access to the newly built roads). This instrument enables public-private partnership and is used in Korea and Japan, and recently in the region, in several Colombian cities and in the province of Buenos Aires, Argentina. In the case of the Buenos Aires municipality of Trenque Launquen, the application of this mechanism in 2011 enabled the landowners to contribute to the financing of the infrastructure required for the expansion of the urban perimeter (Duarte and Baer, 2013).

Conclusions

Analyzing the determinants of land use and urban structure in Latin American cities is fundamental to guiding public policies that seek to promote the benefits of agglomeration, and at the same time, keep congestion costs under control. This chapter aims to contribute along these lines, by making a diagnosis of Latin American urban structure in a comparative context. This analysis is nevertheless limited by the lack of disaggregated information on population, employment, density, built-up areas, land cost and other factors that would enable a systematic study of internal urban structures in the region, and their evolution through time. This deficiency called for the generation of new evidence based on alternative sources such as the AEU, BEAM, information on employment distribution available for 35 metropolitan areas in Brazil, and data on land value, employment access and available land use for the metropolitan areas of Argentina.

In the past few years, urban growth and changes in city structure have become relevant issues for public policy in Latin America and around the globe. The debate on urban shape is often extremely oversimplified and reduced to the discussion of expansion versus compactness (increased density) of cities. This conceptual simplification has helped to root a generalized perception that urban growth in extension is undesirable, since it diminishes accessibility by increasing commuting time, causing environmental deterioration, reducing agglomeration economy and productivity. This explains why so many cities have adopted land use policies seeking to limit urban expansion.

However, this is not necessarily so. A growth in urban extension combined with an adequate land use regulation (opening new residential and business

areas in suburban and peripheral locations) and the necessary infrastructure (such as roads, public transport, tap water and sewer services) can facilitate the access to quality housing without necessarily compromising access to jobs and other services. This happens not only because improvements in transport infrastructure facilitates commuting, but also, because the decentralization of the population could boost the emergence of business and services subhubs in suburban areas. This process of suburbanization is also motivated by trends such as increasing households' income, and technological improvements that reduce commuting costs, which could explain the growth in urban extension occurring in developed countries.

Bearing in mind the significant differences within the region, evidence for Latin America suggests that urban expansion has been limited and mostly chaotic when compared to other regions. Population has concentrated in central areas that concentrate employment opportunities, while those living in peripheral areas suffer restricted accessibility due to the poor quality or the complete absence of public transport and the lack of adequate roads infrastructure. This has led to an increase in the demand for centrally located housing, driving up their market price, thanks to restrictive land use regulations. The high prices in turn prevent families of middle-low to low income to access the formal housing market, resulting in the emergence of slums and the growth and densification of existing ones. This process explains why cities in Latin America and other developing regions are characterized by relatively high population density and high levels of segregation coupled with informality.

The documentation of these dynamics is very relevant from a public policy perspective, since this information constitutes a fundamental input for planning an organized expansion and closing the infrastructure (transport, water and sewage network, etc.) gap between central and peripheral areas. This infrastructure investment must be complemented with a better land use planning and regulation that foster the supply of formal housing as well as provide space for mobility infrastructure and other critical facilities (shopping areas, amenities, etc.).

In short, urban policy needs to shift its focus. The goal should not be to have a larger or more compact city. The goal is to achieve higher accessibility, which can be obtained both in a monocentric city of relatively low extension and high density through a good quality of massive public transit system (i.e., trains and subways) as well as in a more extended, polycentric city, where highways, the use of cars and the decentralization of employment equally allow families access to jobs and other services.

Prioritizing accessibility is particularly important to transform Latin American cities into drivers of productivity growth. However, the scarcity of information and empirical knowledge limits the promotion of this approach. Hopefully the evidence discussed in this chapter would encourage carrying out more comparative studies that would allow evidence-based policies that promote urban development and wellbeing.

Appendix

Table A 2.1 Details about the data of the Atlas of Urban Expansion

	City	Country	Group	Period	Urban population (circa 2015)	Built-up area in hectares (circa 2015)	Population density over built area (circa 2015)
North America	Gainesville	United States	1	1990-2013	175,756	7,663	23
	Killeen	United States	1	1990-2013	225,248	17,686	13
	Victoria	Canada	1	1990-2013	318,267	13,351	24
	Modesto	United States	1	1992-2014	458,146	22,728	20
	Toledo	United States	1	1990-2014	489,974	33,057	15
	Springfield	United States	1	1991-2014	530,272	36,637	14
	Raleigh	United States	2	1990-2013	1,188,416	78,270	15
	Cleveland	United States	2	1990-2013	1,865,023	116,854	16
	Portland	United States	2	1990-2014	1,904,409	88,455	22
	Minneapolis	United States	2	1990-2014	2,626,920	142,874	18
	Montreal	Canada	3	1990-2013	3,317,850	89,185	37
	Houston	United States	3	1990-2014	5,399,338	272,394	20
	Philadelphia	United States	3	1990-2014	5,852,880	298,214	20
	Chicago	United States	3	1989-2014	8,913,778	510,972	17
	Los Angeles	United States	3	1990-2014	15,138,973	459,047	33
	New York	United States	3	1991-2011	18,412,093	747,852	25
Europe	Zwolle	Holland	1	1990-2014	108,237	3,197	34
	Oldenburg	Germany	1	1990-2013	158,329	3,781	42
	Le Mans	France	1	1992-2013	179,135	5,974	30
	Halle	Germany	1	1990-2010	235,706	6,721	35
	Lausanne	Switzerland	1	1987-2015	306,229	6,495	47
	Palermo	Italy	2	1987-2013	822,940	13,249	62
	Salonika	Greece	2	1990-2011	859,431	10,568	81
	Sheffield	England	2	1992-2013	1,166,836	27,394	43
	Ambers	Belgium	2	1990-2013	1,277,376	43,115	30
	Vienna	Austria	2	1991-2013	2,025,195	36,563	55
	Manchester	England	2	1989-2010	2,585,614	51,040	51
	Berlin	Germany	3	1990-2013	3,860,243	68,743	56
	Madrid	Spain	3	1991-2010	5,256,249	56,019	94
	Milan	Italy	3	1988-2013	6,402,051	178,364	36
	Paris	France	3	1987-2014	11,114,026	198,626	56
	London	England	3	1989-2013	11,197,941	177273	63

Continued ›

	City	Country	Group	Period	Urban population (circa 2015)	Built-up area in hectares (circa 2015)	Population density over built area (circa 2015)
Latin America	Ilheus	Brazil	1	1993-2013	97,888	1,513	65
	Jequie	Brazil	1	1992-2014	128,045	2,511	51
	Palmas	Brazil	1	1990-2013	154,873	4,228	37
	Leon	Nicaragua	1	1993-2010	160,355	1,544	104
	Holguin	Cuba	1	1987-2014	263,345	2,157	122
	Valledupar	Colombia	1	1989-2011	392,935	2,688	146
	Cabimas	Venezuela	1	1989-2014	460,894	9,488	49
	Reynosa	Mexico	1	1991-2013	479,078	12,028	40
	Florianopolis	Brazil	2	1990-2014	532,951	10,210	52
	Ribeirao Preto	Brazil	2	1990-2014	607,350	10,917	56
	Culiacan	Mexico	2	1990-2014	625,346	11,563	54
	Cochabamba	Bolivia	2	1990-2013	1,034,944	16,736	62
	Cordoba	Argentina	2	1991-2014	1,392,944	24,542	57
	San Salvador	El Salvador	2	1991-2014	1,693,748	16,889	100
	Tijuana	Mexico	2	1989-2014	1,706,084	28,626	60
	Quito	Ecuador	2	1988-2013	2,173,697	22,665	96
	Guatemala City	Guatemala	2	1990-2013	2,654,085	26,506	100
	Curitiba	Brazil	3	1990-2014	2,728,388	44,527	61
	Caracas	Venezuela	3	1991-2014	3,104,392	16,352	190
	Bello Horizonte	Brazil	3	1989-2013	4,038,047	48,701	83
	Guadalajara	Mexico	3	1990-2014	4,375,721	51,625	85
	Santiago de Chile	Chile	3	1990-2014	6,486,535	60,381	107
	Bogota	Colombia	3	1989-2010	7,801,693	31,895	245
	Buenos Aires	Argentina	3	1989-2014	13,879,006	147,306	94
	Mexico City	Mexico	3	1990-2014	17,765,121	161,821	110
	Sao Paulo	Brazil	3	1988-2014	19,609,222	172,428	114

Source: Authors' elaboration using data from the AUE, Angel et al. (2016a).

Table A 2.2 Details about the data on Brazilian metropolitan areas covered by García-López and Moreno-Monroy (2016)

City	Group	Population (2010)	Employment (2010)	Number of subcenters (2010)	CBD censity (2010)	Subcenter density (2010)
Juiz de Fora	1	507,706	122,960	1	17,666	2,685
Macapa	1	520,976	97,116	1	16,484	7,190
Blumenau	1	557,916	208,793	1	5,256	3,401
Feira de Santana	1	581,673	106,311	1	10,977	2,818
Jundiai	1	643,405	184,637	1	9,944	9,371
Limeira and Rio Claro	1	687,560	165,295	1	7,258	5,128
Barra Mansa and Volta Redonda	1	734,239	135,368	1	4,540	10,383
Joinville	1	751,921	250,244	2	10,514	2,613
Campo Grande	1	770,308	162,119	2	11,665	1,522
Ribeirao Preto	1	841,303	214,200	0	9,488	0
Aracaju	1	845,586	177,622	1	15,655	4,242
Florianopolis	2	854,379	318,313	2	37,088	5,221
Londrina	2	919,110	249,778	2	13,510	4,157
Uberlândia	2	971,015	252,706	2	13,990	9,075
João Pessoa	2	975,491	197,885	2	29,685	9,730
Teresina	2	976,974	203,802	1	20,890	6,999
Maceio	2	1,007,579	170,672	1	19,930	5,492
Cuiaba	2	1,091,538	218,276	0	5,884	0
Sorocaba	2	1,138,453	257,475	0	7,314	0
Natal	2	1,170,628	297,219	2	24,519	8,357
Sao Jose dos Campos	2	1,342,316	327,817	6	8,814	9,841
Grande Vitoria	2	1,538,470	436,177	2	22,798	16,057
Baixada Santista	2	1,653,007	310,296	3	17,015	14,925
Goiania	3	2,032,443	552,630	5	24,028	12,555
Manaos	3	2,108,576	414,005	3	13,569	7,251
Curitiba	3	2,868,201	1,031,859	4	38,494	8,311
Campiñas	3	2,907,717	763,146	3	25,067	10,787
Salvador	3	3,450,085	910,399	6	37,972	23,709
Fortaleza	3	3,457,399	699,056	4	24,439	4,829
Brasilia	3	3,494,740	727,784	6	28,284	5,705
Recife	3	3,613,199	819,317	5	38,411	14,316
Bello Horizonte	3	4,696,870	1,505,247	13	44,751	15,261
Puerto Alegre	3	5,945,448	1,472,610	7	31,156	7,968
Rio de Janeiro	3	11,591,159	2,350,702	15	171,061	20,679
Sao Paulo	3	19,385,152	6,684,113	33	157,961	29,674

Source: Authors' elaboration based on García-López and Moreno-Monroy (2016).

MOBILITY FOR ACCESSIBILITY

Chapter 3

Chapter 3
MOBILITY FOR ACCESSIBILITY[1]

Introduction

City inhabitants need to move around within the urban space to take advantage of the employment opportunities, social services and amenities available within the city. That is, to participate in and benefit from urban life. Moving around within a city is so important that the urban population spends a significant part of their resources to achieve this goal. On average, urban households in Latin America allocate between 6% and 19% of their monthly expenditure to transport. In addition, this activity consumes a significant portion of their time.[2]

If urban mobility is difficult or expensive, agglomeration economies, and therefore a city's advantages, decrease. For example, if the inhabitants of a neighborhood face obstacles in traveling to the areas where hiring firms are located, people are faced with a disadvantage because they have fewer employment options, and firms are also hindered because they have fewer hiring options. Deficiencies in mobility may also make cities less habitable in other areas. According to international statistics, most cities in Latin America have high levels of traffic congestion and environmental pollution, and low levels of road safety. Motorized transport, particularly the use of cars, produces many of the congestion costs associated with urbanization that are outlined in Chapter 1. In this sense, there is significant concern regarding the expansion of this means of transport in Latin America. Among the 29 cities in the region that are monitored by CAF's Urban Mobility Observatory (UMO), the number of cars expanded from 25 million to 35 million between 2007 and 2014, corresponding to an increase of 40% in just seven years (while population growth in those cities was around 10% in the same period). Similarly, the number of motorcycles almost tripled during that period, increasing from 2.8 million to 7.2 million (Vasconcellos and Mendonça, 2016). If economic growth in the region continues, this trend may be strengthened, as demand for private car use increases in line with household income.

Despite the advances described in this chapter, public transport, the main urban mobility alternative in the region, faces significant challenges in terms of coverage and quality. According to the 2016 CAF Survey, more than 20% of Latin Americans do not have access to a formal public transport means less than 10 minutes away from their place of residence, a figure which increases

1. This chapter was written by Fernando Álvarez and Ricardo Estrada, with research assistance from Roberto Ferrer, Juan Sebastián Ivars and Federico Juncosa.

2. The 2016 CAF Survey found that the region's inhabitants spend around 40 minutes commuting from their homes to their place of work (one-way only). In cities such as Sao Paulo, Bogota, Quito, Mexico City, Panama City and Lima, a quarter of the population spends at least one hour per day commuting to their place of Lima, a quarter of the population spends at least one hour per day commuting to their place of work work.

25% of respondents in 11 Latin American cities are highly dissatisfied with public transport.

among inhabitants of informal settlements. In these neighborhoods, informal transport complements coverage, but only partially: around 15% of households in informal settlements do not have access to any type of public transport. In addition to the issue of a lack of proximity to public transport options, fares are also restrictive. Due to the high prices in relation to the lowest household income levels in the region, these households frequently travel on foot or by bicycle, which negatively affects the number of jobs that they are able to access. Regarding service quality, 25% of respondents are highly dissatisfied with public transport, especially in regard to the frequency and duration of journeys, and the safety of the vehicles.

Traffic congestion levels, as well as the availability and quality of public transport, depend largely on existing mobility infrastructure (such as streets, sidewalks, bridges, exclusive public transport and bicycle lanes, etc.). This impacts not only individual commute patterns, but also the residential distribution of the city's inhabitants, the city's size and its layout. The little evidence available suggests that mobility infrastructure in Latin America is scarce and, also, that it is distributed and used in an inefficient and inequitable manner. This problem is significant, because mobility infrastructure is one of the most important mechanisms through which public policies can have an impact, via investment and regulations, on the extent to which households are able to access a city's benefits, and therefore the wellbeing of its population.

This chapter includes an analytical framework which examines the mechanisms available for public policies to influence urban mobility and, through this, cities' development and the wellbeing of their inhabitants. Similarly, this chapter offers an assessment of mobility patterns in Latin America, as well as its costs, and analyzes the different public policy alternatives that may impact urban mobility directly or indirectly.

Analytical framework

Cities favor agglomeration economies, increasing the productivity and diversity of available goods and services. In such cities, their inhabitants find opportunities to live, work, entertain themselves, and accumulate wealth and human capital. Access to these opportunities determines citizens' wellbeing. However, this requires the ability to commute from one place to another, as opportunities are distributed throughout the city's territorial span. In this sense, mobility is not an end in itself, but rather a necessary means for accessing the set of opportunities that a city offers. Although they are sometimes used interchangeably, the terms 'mobility' and 'accessibility' are distinct concepts which it is appropriate to separate (Handy, 2002, and Litman, 2003).

Mobility is associated with the physical space that may be potentially reached through commuting, from a specific point of origin and using the available transport means and routes. Due to the fact that these means and routes vary within cities, mobility is specific to each particular location. Commuting from

an area with extensive and modern highways (or metro lines nearby) is not the same as commuting from another area in the city characterized by narrow and unpaved roads.[3] Despite the fact that mobility is defined as a potentially reachable distance, the most common measurement in practice is the number of kilometers traveled.

While the focus of mobility is on the reachable area, the focus of accessibility is on reachable opportunities.

In contrast, accessibility (also see Chapter 1) refers to the quantity and quality of reachable opportunities for an individual, in accordance with their mobility. As such, while the focus of mobility is on the reachable area, the focus of accessibility is on reachable opportunities. In that sense, the measurement of accessibility is more complex than mobility, as while the physical space is homogeneous and quantifiable, opportunities and interactions are not.[4] Even with this difficulty, accessibility must be considered a priority concern for urban development policy, given its close connection with citizens' quality of life.

The connection between mobility and accessibility operates through two channels. First, it is clear that mobility increases access to opportunities mechanically, as it facilitates commuting between the different areas of a city. In addition to this direct channel, good mobility favors the emergence of new opportunities, because it improves the quantity and quality of job matching, and promotes the dissemination and exchange of ideas and knowledge. That is, high mobility costs imply lower accessibility for a city's inhabitants and, in turn, low accessibility reduces potential agglomeration economies by reducing the city's effective size.[5]

Improving mobility implies addressing equity and efficiency challenges. With regard to equity, the problem is that accessibility levels vary within cities. In that sense, individuals who have limited mobility due to their location and resources cannot take advantage of the employment, education and recreation opportunities offered by urban life, or can only do so at a very high cost.[6]

With regard to efficiency, mobility is associated both with the aforementioned benefits, and a series of negative externalities. The problem is due to the fact that individual decisions regarding commuting impose negative externalities on the rest of society, related to traffic congestion, road safety and environmental

3. From a broader viewpoint, in terms of mobility, it is not only the physical distance traveled, but also the quality of commuting that matters, for example in terms of comfort and safety.

4. For this reason, attempts to measure accessibility are usually conducted by opportunity type, for example, employment opportunities. In Chapter 2, this exercise is performed for the case of Buenos Aires.

5. In Chapter 1, a detailed analysis of the mechanisms that explain the relationship between a city's size and agglomeration economies is provided.

6. There is evidence for the United States indicating that greater employment accessibility reduces the duration of unemployment. In addition, the effect appears to be more significant for vulnerable groups such as African Americans, women and older workers (Andersson et al., 2014).

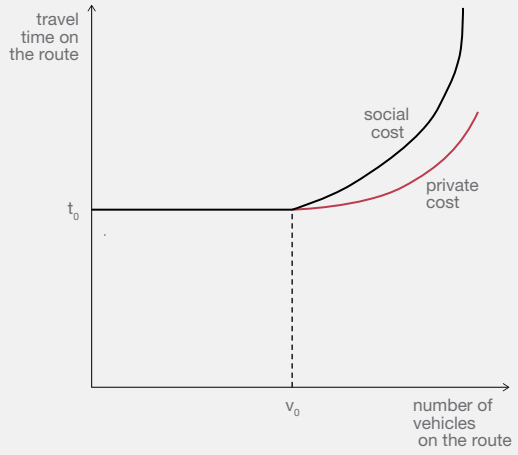
pollution (see Text box 3.1, for the case of traffic congestion).[7] That is, the use of motorized transport, and mainly the use of private cars, implies a series of costs that are not fully taken into account by individuals.

Text box 3.1 Traffic congestion and the social cost of car use

Traffic congestion is part of daily life in large cities. The image of long lines of cars trapped in a bottleneck threatens to become the visual definition of the modern metropolis. The origin of traffic congestion is well known. First, transport demand has peaks in terms of space and time, due to the spatio-temporal distribution of the opportunities offered by a city. Secondly, providing road infrastructure to satisfy these demand peaks is highly costly and inefficient, as it would require the construction of roads that would remain empty most of the time. Therefore, a certain level of congestion within cities is inevitable.

However, the lack of adequate public policies usually generates an excessive degree of traffic congestion from a social viewpoint. Graph 1 (adapted from Bull, 2003) visually summarizes the nature of this issue. The graph presents two curves: the private cost curve represents transit times for different levels of vehicle flow (depicted on the horizontal access), and the social cost curve represents the increase in waiting times for all drivers upon adding a vehicle to a specific level of vehicle flow. The difference between the two curves therefore represents the increase in transit times for other vehicles in circulation resulting from the introduction of the additional vehicle.

Graph 1 Car use and congestion



7. On an individual level, the means of commuting from one place to another depends on the comparison between available options in terms of travel times, comfort, safety and cost (considering both monetary costs and the travel time required which, in turn, depends on individuals' income, family structure, education level and the area of the city in which they live, among other factors).

It can be observed that for the first vehicles that travel on the route, the private cost and social It can be observed that for the first vehicles that travel on the route, the private cost and social cost are equal, with a magnitude of t_0. However, from a critical level of vehicles on the route (v_0), not only do additional drivers face an increased cost, but the cost also increases for all other drivers on the route. As such, it may be stated that from v_0, the route starts to become congested, as each additional vehicle imposes a cost (in terms of travel time) on all other vehicles in circulation. This social cost, which the additional driver does not consider when deciding whether to use the route, is known as a negative externality. Indeed, it is foreseeable that when deciding how to commute, each citizen only considers their private cost, and not the way in which their behavior affects the cost of others. In this way, the externality causes congestion levels to be inefficiently high.

There are public policies (such as congestion tax) whose aim is for the population to internalize these costs, in order to reduce the externality. On the other hand, there are also policies that exacerbate this type of externalities, as is the case of fuel subsidies, which are in force in some Latin American countries.

The use of urban space requires coordination between its different objectives, and balance between the benefits of agglomeration and the negative externalities that this generates. Due to this complexity, the market is not able to internalize these forces by itself, which, together with equity considerations, opens a space for public policy interventions and, in particular, mobility policies. Mobility policies aim to modify a city's mobility patterns through at least three instruments:[8] regulations on the use of private cars; ii) changes in mobility infrastructure, including both roads and urban infrastructure linked to the use of alternative means of transport, such as bicycles (through the construction of bicycle lanes) or on foot (through the construction of sidewalks); iii) interventions that impact on the public transport system. In the last section of this chapter, each of these public intervention options have been analyzed in detail.

This chapter places emphasis on urban mobility as a mechanism for accessibility. In this sense, the increase in transporting people and goods, or the reduction of traffic congestion, which many mobility policies pose as an explicit objective, should be considered as intermediate instruments for achieving the ultimate goal of favoring greater accessibility and, at the same time, aiming to minimize the negative externalities of mobility and commuting costs.

Mobility aspects are also addressed, considering fixed the spatial distribution of job opportunities within the city as well as its physical layout, as discussed in Chapter 2, referring to the simultaneity of mobility and location decisions.

8. The expression 'mobility patterns' refers to the aggregation of all routine commutes of the city's inhabitants, such as traveling from home to work at a certain time, via a specific route, and using a determined mode of transport. Mobility patterns depend on the spatial distribution of opportunities, which are defined by the city's layout, size, density, and land use, as well as the supply of transport means and, more generally, mobility policies. As can be observed in the following section, these patterns vary significantly between cities.

Public transport is the most widely used means of transport in the cities of the region.

However, from a conceptual viewpoint, it is important to recognize that the relationship between mobility and a city's layout is bidirectional, as is the interdependence between transport demand and housing demand, and between mobility policy and land use policy.[9] For example, a land use policy that separates residential areas from areas of business activity will increase the average distance between housing and work and, therefore, will increase the demand for motorized means of transport. Similarly, the construction of road infrastructure that enables faster access to certain areas increases residential demand in those areas, as well as house prices.

Urban mobility assessment

The use of means of transport

A good starting point for analyzing urban mobility is to investigate which means of transport are used by the region's inhabitants. According to UMO data for 29 Latin American cities, public transport is the most widely used means of transport in the cities of the region, accounting for 39% of all journeys, followed by commuting on foot (26%), and by private car (22%).[10] Together, almost 90% of journeys in the region are carried out through one of these three means of transport: The least-used means of transport are motorcycles (5%), taxis (2%) and bicycles (2%). Due to the challenges involved in measuring mobility patterns, these averages must be interpreted with caution (see Text box 3.2).

Text box 3.2 Measurement of mobility patterns

The design and evaluation of evidence-based public policies on urban development and mobility require, as a starting point, detailed and representative information on the population's commuting habits in Latin American cities. The purpose of transportation surveys is to obtain this information. This type of survey uses data collection tools that enable a 'travel diary' to be constructed for respondents, covering a specific reference period. This diary records the main transport characteristics, such as the purpose of the journey, the means of transport used, the time of day at which the journey is performed, its duration, the distance traveled, and the location of the points of origin and destination. In addition, it aims to obtain complementary

9. There are other interventions that operate as substitutes for mobility, but that share the objective of improving access to opportunities, such as teleworking or the promotion of internet use to conduct transactions (for example, purchases, payments, bank transactions, etc.).

10. The figures have not been adjusted by population, for them to be representative of the entire region and not only of the most populated cities. More detailed information can be found on the UMO website (CAF, 2017).

information on expenditure and access to means of transport, as well as the household's socioeconomic characteristics.

Origin-destination surveys constitute inputs for generating assessments of mobility conditions in urban areas and the mobility patterns of different population groups. Furthermore, they permit studies to be conducted on transport demand, both on an aggregate level and by the socioeconomic profile of the population, or on the effectiveness of specific actions adopted in order to improve the transport system. Therefore, as mentioned previously, these surveys are key for the design (and evaluation) of evidence-based public policies on urban development and mobility.

An increasing number of cities in the region conduct transportation surveys. However, their generalized and systematic adoption is still incipient, with deficiencies in terms of coverage, frequency and homogeneity. As such, the first challenge for urban mobility policy in Latin America consists in establishing an institutional framework for conducting periodic transportation surveys that are comparable between cities. This framework should establish the sample of cities in which this type of survey should be conducted, their frequency and the methodological criteria required to guarantee the quality and homogeneity of information.

The implementation of surveys on a city level should be complemented by actions that aim to collect representative information on a national level. As a reference, in the United States, the National Household Travel Survey (NHTS) obtains data on all journeys conducted by households in the country, with a frequency of approximately every six years. Also in the United States, the population census investigates work commuting patterns through its long form questionnaire (which is completed by almost 17% of households). For its part, in France, the National Institute of Statistics (INSEE, by its French acronym) does something similar every 10 years (the *Enquête Nationale Transports et Déplacements*). In Latin America, the Mexican Intercensal Survey 2015 incorporated a similar exercise to that of the US census, with a sample size of more than 6 million households.

Finally, new technologies are giving rise to the possibility of obtaining mass information generated in real time (big data) on the mobility patterns of a city's inhabitants. Specifically, this is referring to information produced on a daily basis by the large number of electronic devices (smartphones, GPS, etc.) that circulate in a city. Currently, CAF, together with the University of Toronto, is implementing actions that aim to take advantage of this type of information as a complement to the Montevideo Mobility Survey 2016 (Alcalá and Hernández, 2016).

The figures available for Europe establish a context for Latin American averages. In Europe, private cars tend to be the main mobility option (accounting for 54% of journeys), followed by public transport (23%) and travel on foot (11%).[11] That is, in Latin American cities, the ratio of journeys

11. It is important to clarify that, unlike the UMO figures, which refer to the universe of journeys conducted by households, regardless of the purpose of the journey, the information available for Europe (which covers 30 cities across the continent, and whose source is the Organisation for Economic Co-operation and Development) only refers to commutes between home and work, which tend to be more intensive in the use of motorized transport means.

Journeys by private car in Latin America tend to be less than half compared to Europe.

by private car tends to be less than half compared to Europe, while the number of journeys via public transport and on foot almost double those of the old continent. This pattern coincides with the evidence presented below regarding the positive correlation between the use of private cars and per capita income levels of a city or country.

Regarding travel on foot, it is useful to consider that the data analyzed refers to journeys in which most the route is completed on foot. However, users of other means of transport also frequently walk for a portion of the route. Specifically, transport on foot is a complement to public transport, and even private cars, when the available parking spaces are far away from places of work. Therefore, it is possible that the actual importance of this form of mobility is greater than the data would suggest at first glance.

The general overview described for Latin America encapsulates differences in the mobility patterns of cities in the region. For example, public transport is used in 59% of journeys in Caracas and 57% of journeys in Quito, Mexico City and Lima. The levels of public transport use in these cities are comparable to European cities in which public transport is used with greater intensity (for example, Paris, where it accounts for 57% of journeys). In contrast, public transport is used in just 22% of journeys conducted in Cali (Colombia), and 26% in Belo Horizonte (Brazil).

For its part, Brasilia (41%), Montevideo (39%) and Panama City (36%) are the cities that, proportionally, have the highest levels of private car use, although this is lower than the European cities with the most intensive car use, such as Seville (80%) in Spain, Marseille (72%) in France, or Turin (71%) in Italy. In contrast, there are Colombian cities in which less than one in 10 journeys are conducted in private car: Barranquilla (6%), Pereira (8%) and Montería (8%). Finally, proportionally, in Belo Horizonte (40%) and Recife (39%), in Brazil, and Guadalajara (37%) in Mexico, more journeys on foot are recorded than in the rest of the region, while Caracas (14%), Montevideo (11%) and Panama City (8%) are the cities with the lowest levels recorded for this form of transport. Among the cities with the highest presence of transport alternatives, Montería (24%) and Cali (18%), in Colombia, and San José (16%), stand out for motorcycle use; Montería in Colombia (9%), Rosario in Argentina (9%) and Porto Alegre in Brazil (7%) for bicycle use; and Panama City (9%), Medellín in Colombia (7%) and Buenos Aires (7%) for the use of taxi services.

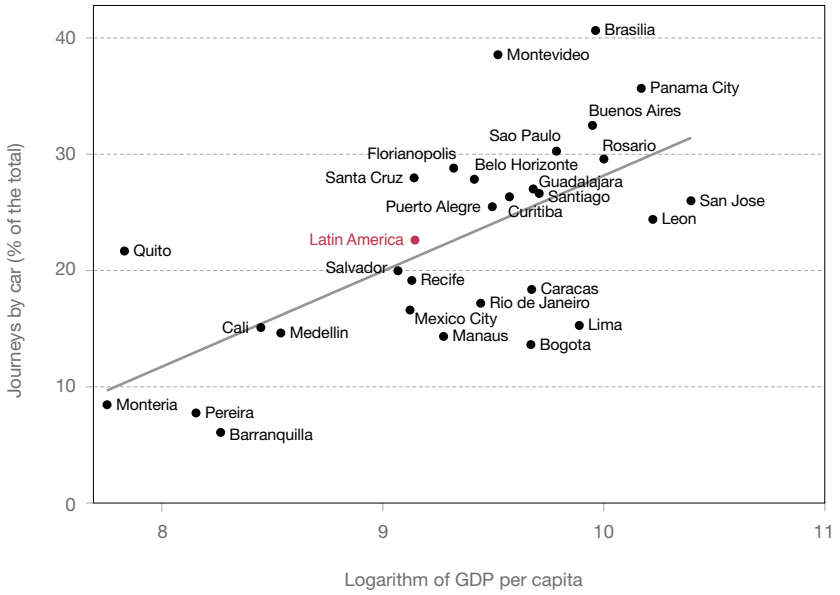
In summary, there is extensive variation in the mobility patterns of cities in the region. As indicated previously, the means of transport that account for most journeys conducted in these cities are public transport, private car and travel on foot. However, in some cities, the motorcycle, bicycle and taxi play a significant role. On the other hand, evidence of one means of transport being close to accounting for the entirety of journeys is not observed in any city. In contrast, in most cities in the United States, 90% of journeys are done in private cars (Duranton and Guerra, 2016). In this sense, the distribution of journeys by transport modality in the region more closely resembles those of European cities.

Private car use: The role of per capita income and population density

There is a consistent pattern between the type of transport used in a city, its per capita income level and population density. Graph 3.1 displays the relationship between the percentage of journeys that are conducted in private cars and the per capita income level in the sample of cities monitored by the UMO. As can be observed, private car use tends to be greater in cities with higher per capita income.[12] Remarkably, per capita income variation explains approximately half of the variation in private car use in these Latin American cities.[13]

Graph 3.1 Relationship between the percentage of journeys by private car, GDP per capita and population density for several Latin American cities

Panel A: Journeys by car and GDP per capita [a/]

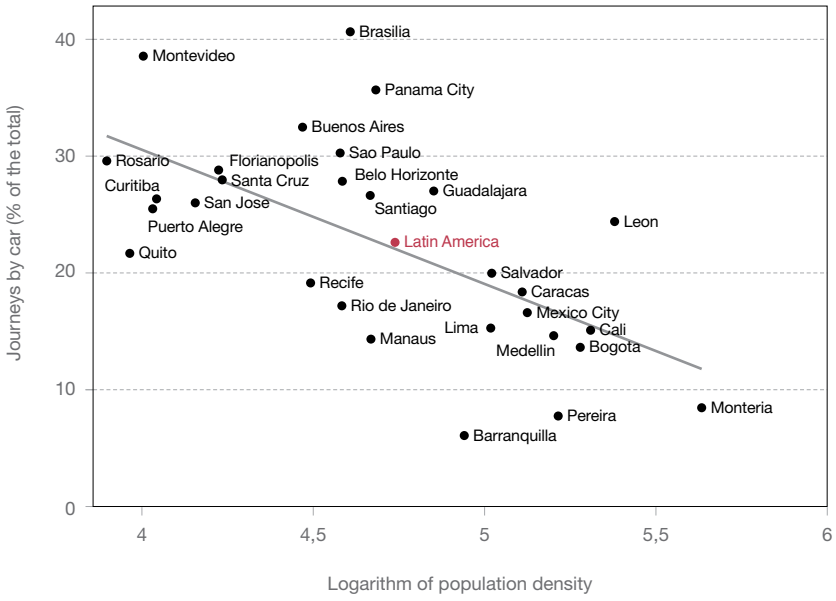


Continued ›

12. This positive correlation is not exclusive to the region. It can also be observed on an international level. For example, using data from the World Health Organization (WHO) on the number of cars per capita, and World Bank data on per capita income levels for a sample of 162 countries, it can be determined that above a minimum income level (below which the availability of cars is very low), there is a positive correlation between these two variables.

13. Using R2 of the regression displayed in panel A of Graph 3.1.

Panel B: Journeys by car and population density [b/]



a/ The graph displays the correlation between the percentage of total journeys in a city made by private car, and GDP per capita, PPP. The data for the first variable were obtained from the UMO. GDP per capita data were obtained from: for Belo Horizonte, Brasilia, Caracas, Curitiba, Guadalajara, Lima, Manaus, Porto Alegre, Recife, Rio de Janeiro, Salvador, and Santiago de Chile, from the Brookings Institution's 2014 Global Metro Monitor Map report; for Buenos Aires, based on GDP data obtained from the Bureau of Statistics and Census of the City of Buenos Aires (DGEyC, 2016) and/or the Ministry of Economy of the Province of Buenos Aires Statistics Office (DPE, 2016), and population data from the National Institute of Statistics and Census (INDEC, 2015); for Bogota, based on data obtained from the National Administrative Department of Statistics (DANE, 2014) for the city; for Quito, using the official statistics bulletin of the Municipality of the Metropolitan District of Quito (2016), released by Instituto de la Ciudad de Quito, which forms part of the municipality; and for Santa Cruz de la Sierra, GDP per capita data were obtained from the National Statistics Institute (INE, 2016).
b/ The graph displays the correlation between the percentage of journeys by private car and population density in those countries. Population and car journey data were obtained from the UMO, while surface area data used to calculate population density were obtained from BEAM.

Source: Authors' elaboration based on data from the World Bank, BEAM (CAF, 2016), Ch et al. (2017), Brookings, DANE, Metropolitan District of Quito, DGEyC, DPE, INE and UMO (CAF, 2017).

The correlation between private car use and a city's per capita income level is the result of two effects; one related to demand, and the other linked to transport supply. On the demand side, there is a positive relationship between household income levels (which are greater in more prosperous cities) and private car use (an issue that will be examined in greater depth later on). On the supply side, it is foreseeable that cities with higher income levels will have more extensive road infrastructure, which facilitates private car use.

Panel B of Graph 3.1 displays the relationship between the percentage of journeys conducted by private car, and the population density of cities monitored by the UMO. As can be observed, private car use tends to be lower in the most

densely-populated cities. This is probably due to population density favoring the development of public transport supply, due to the existence of economies of scale in the provision of this service.[14]

In a sample of Latin American cities, the number of cars grew by 40% between 2007 and 2014, while the number of motorcycles almost tripled in the same period.

The expansion of private motorized transport

The lack of transportation surveys conducted in the same city at two sufficiently distant moments in time (see Text box 3.2, p. 124) limits the possibility of specifying how the mobility patterns of cities in the region have changed in recent decades. However, an alternative that may be of use to illustrate private motorized transport trends is the analysis of car and motorcycle market performance.

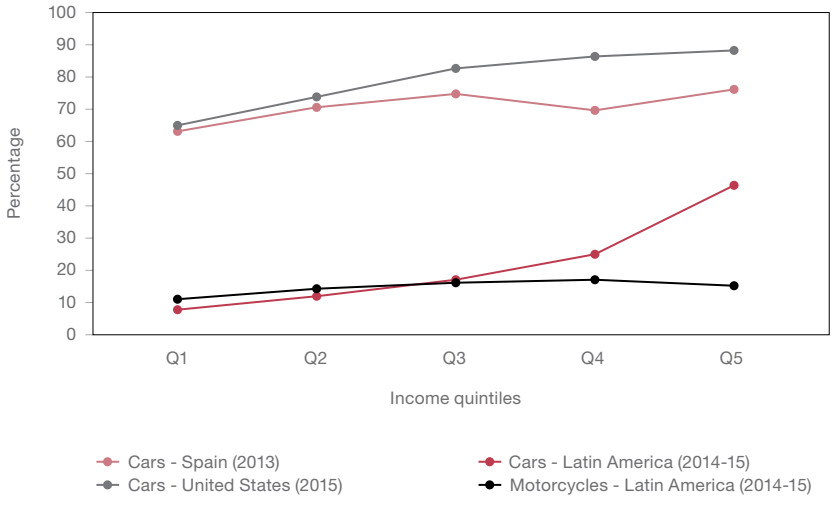
As mentioned at the beginning of this chapter, in the 29 cities monitored by the UMO, the total number of cars grew by 40% between 2007 and 2014, increasing from 25 million to 35 million. For its part, the total number of motorcycles almost tripled during the same period, increasing from 2.8 million to 7.2 million. The expansion of private motorized transport is the result of several factors, including economic development. Following decades of economic growth and inequality reduction in many countries in the region, average household income in Latin America has increased. This increase translates into an expansion of vehicle demand, as cars are a normal good, that is, their demand increases with income.[15]

Graph 3.2 (see p. 130) shows the percentage of households per income quintile that own at least one vehicle (car or motorcycle), based on the average of 14 countries in the region, and data from Spain and the United States, which is used as a reference. A positive relationship can be observed between household income and ownership of at least one car. While, on average, 46% of households in the highest-income quintile own at least one car, that figure reaches just 8% for the lowest-income quintile of each country (the 20% of households which report the lowest income levels). These averages conceal significant variation between countries, which in turn is related to the income level of each country. For example, almost a sixth of households in the lowest-income quintile in Chile, Costa Rica and Uruguay own at least one car, while in Colombia, Guatemala, Nicaragua and Peru, that figure reaches just 2%. As can be expected due to differences in per capita income levels, the figures from countries in the region are far from Spain and the United States, where more than 60% of households in the lowest-income quintile own at least one car.

14. The negative correlation between car use and population density persists even when controlling for cities' income levels, using multiple regression analysis.

15. Conceptually, this increase in demand does not necessarily apply to motorcycles. On the one hand, higher income levels enable households that previously did not have access to any private vehicle to own a motorcycle. However, it is also likely that households which previously were only able to purchase this type of vehicle opt to buy a car.

Graph 3.2 Households that own at least one vehicle (car or motorcycle) by income quintile for Latin America, Spain and the United States [a/]



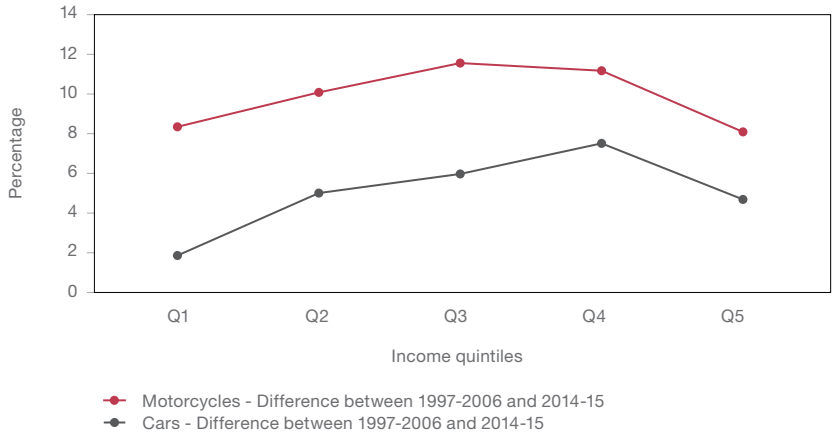
a/ The graph displays the percentage of urban households that own at least one vehicle by income quintile. For Spain and the United States, the data is from 2013 and 2015 respectively. For Latin American countries, a simple average is provided (without adjusting for population size) using data from the countries indicated below. Cars: Bolivia (2014), Chile (2015), Colombia (2014), Costa Rica (2015), the Dominican Republic (2014), Ecuador (2014), El Salvador (2013), Guatemala (2014), Honduras (2014), Mexico (2014), Nicaragua (2014), Paraguay (2014), Peru (2015), and Uruguay (2015). Motorcycles: Bolivia (2014), the Dominican Republic (2014), Ecuador (2014), Guatemala (2014), Honduras (2014), Mexico (2014), Nicaragua (2014), Paraguay (2014), and Peru (2015).

Source: Authors' elaboration based on CEDLAS (2017).

Regarding motorcycles, the relationship between household income and the likelihood of owning at least one motorcycle resembles a type of inverted U shape in the Latin American average during the most recent period for which data is available (also see Graph 3.2). That is, it increases from the low to middle section of the income distribution (probably because lower-income households substitute public transport with motorcycles), and decreases in the highest-income quintile (possible because higher-income households substitute motorcycles with cars). This relationship also varies between countries. For example, in the case of Paraguay, it indeed resembles an inverted U shape, while in Central American countries, the relationship tends to be positive throughout the entire income distribution.[16]

16. Rodríguez et al. (2015) analyzed the factors associated with motorcycle use in five Latin American cities, based on a survey and qualitative interviews. Their results indicate that most motorcycle users perceive this means of transport as a lower-cost alternative to public transport or car use, although with greater risk of accidents. Other advantages include the fact that motorcycles offer more flexibility than public transport, and are more able to cope with traffic congestion than cars. The overwhelming majority of motorcycle drivers are men of working age, who tend to have below-average income and education levels.

Graph 3.3 Variation over time of the percentage of households that own at least one vehicle (car or motorcycle) by income quintile for Latin America [a/]



a/ The graph displays the variation over time of the percentage of urban households that own at least one vehicle by income quintile. A simple average is provided (without adjusting for population size) using data from the countries indicated below. Cars: Bolivia (1999), Chile (2006), Costa Rica (1997 and 2005), the Dominican Republic (2005), Ecuador (1995 and 2006), El Salvador (1995 and 2006), Guatemala (2006), Honduras (2006), Mexico (1996 and 2005), Nicaragua (1998 and 2005), Paraguay (1997 and 2005), Peru (1998 and 2005) and Uruguay (1995 and 2005). Motorcycles: Bolivia (1999), the Dominican Republic (2005), Ecuador (1995 and 2005), Guatemala (2006), Honduras (2005), Mexico (1996 and 2005), Nicaragua (1998 and 2005), Paraguay (1997 and 2005) and Peru (1998 and 2005).

Source: Authors' elaboration based on CEDLAS (2017).

The increase in car and motorcycle use is a phenomenon in which population sectors with different income levels participate.

Significantly, the increase that has occurred in the last two decades in the percentage of households that own at least one vehicle (car or motorcycle) can be observed across countries' entire income distribution (although in the case of cars, this trend is particularly influenced by middle and high-income countries in the region). That is, the increase in car and motorcycle use is a phenomenon in which population segments with various income levels participate (see Graph 3.3).

Characterization of public transport in Latin America

Although metro, tram or train services exist in certain Latin American cities, one of the most striking characteristics of the public transport supply in the region is the dominance of road systems and the relative importance of lower-capacity systems.[17] Indeed, almost 90% of seats correspond to

17. Public transport supply is extremely varied. A common classification is by means of transportation, differentiating between rail (also known as "guided means") or road systems. Trams, trolleys, trains and metro systems are included in the first group, with metros being characterized by generally using underground routes. The second group includes both bus systems and taxis which share routes with private transport, as well as bus rapid transit systems in exclusive lanes. Informal transportation services, which are characterized by their highly fragmented nature, and little or no regulation, also form part of this group. Examples of these services include motorcycle taxis, share taxis, combis, four-by-fours and even minibuses. They also include new services based on technological applications, such as Uber, which in general are not regulated.

The three main problems of public transport in Latin America are the low frequency of service, prolonged travel times and lack of safety.

road systems. Among these, 57% correspond to standard buses, while 28% are associated with minibuses, vans, combis, SUVs, taxis and share taxis (CAF, 2011).

The information provided by the UMO shows that there are varied differences throughout Latin America. According to this database, the number of shared transport seats per 1,000 inhabitants varies from 38 in cities such as Rosario to around 200 in cities such as Lima and Santiago de Chile.[18] This difference can also be observed in terms of infrastructure. The percentage of priority routes for public transport goes from 0% (in cities such as Manaus and Florianopolis in Brazil, Monteria in Colombia and San José in Costa Rica) to around 3% (in Pereira, Colombia).

With regard to public transport fares, according to information from UMO, the average cost of an urban transport journey (with a distance of 7 km) is 27% higher by car than by bus. In contrast, in developed countries, the cost of using cars is 10 times higher than the cost of using shared transport (Vasconcellos and Mendonça, 2016). It should be noted that in some cities in the region, either due to fuel subsidies or the lack of public transport subsidies, this gap is reverted. That is, the cost of traveling in a private vehicle is lower than the cost of traveling on public transport. This is the case in Santiago de Chile or, at the extreme end of the spectrum, Caracas, where gas prices are significantly subsidized.[19]

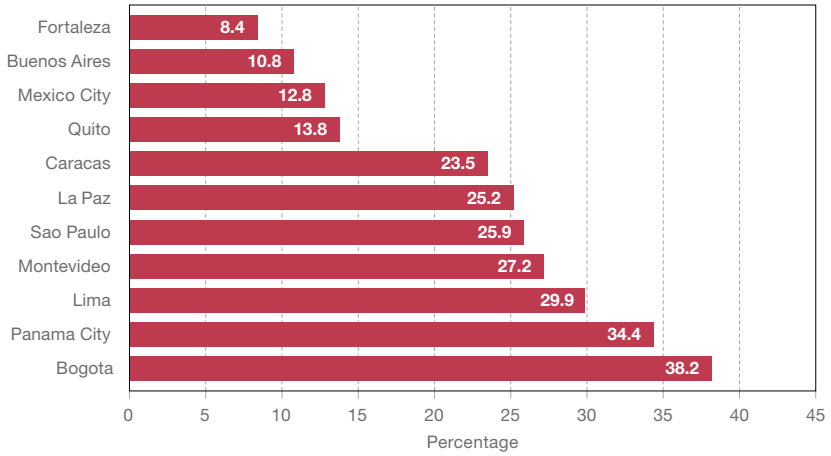
The 2016 CAF Survey reveals significant levels of dissatisfaction with public transport on the part of the inhabitants of cities in the region, in particular Bogota, Panama City and Lima (see Graph 3.4). In seven of the 11 cities that are included in the sample, at least a quarter of respondents said that they were dissatisfied. Meanwhile, the most positively-evaluated public transport systems are those of Buenos Aires and Fortaleza (Brazil).

Similarly, the 2016 CAF Survey enables the aspects of public transport which, according to users in the region, should be improved as a matter of priority to be identified. The three main problems are the low frequency of service, prolonged travel times and lack of safety (see Graph 3.5). Meanwhile, the expansion of coverage in terms of schedules or geographic coverage are identified less frequently as priority issues. The problem regarding lack of safety is even more severe for women (see Text box 3.3, p. 134).

18. On average, in the cities studied by the UMO, there are slightly more than 100 public transport seats per 1,000 inhabitants. When comparing these figures to those of other cities, they do not appear to be particularly low. However, this does not suggest that the public transport supply in Latin America is sufficient, especially when considering the greater dependence on public transport in the region, as described in the previous section.

19. In general, public transport fares receive some type of subsidy in the region. In the case of Buenos Aires, Rosario, Sao Paulo, Santiago de Chile, Quito and Montevideo, bus systems are subsidized. The same happens with rail systems in Buenos Aires, Belo Horizonte, Porto Alegre, Recife, Sao Paulo, Santiago de Chile, Mexico City, Panama City and Caracas. In cities such as Buenos Aires and Caracas, subsidies correspond to 239% and 117% of fares collected, respectively (Vasconcellos and Mendonça, 2016).

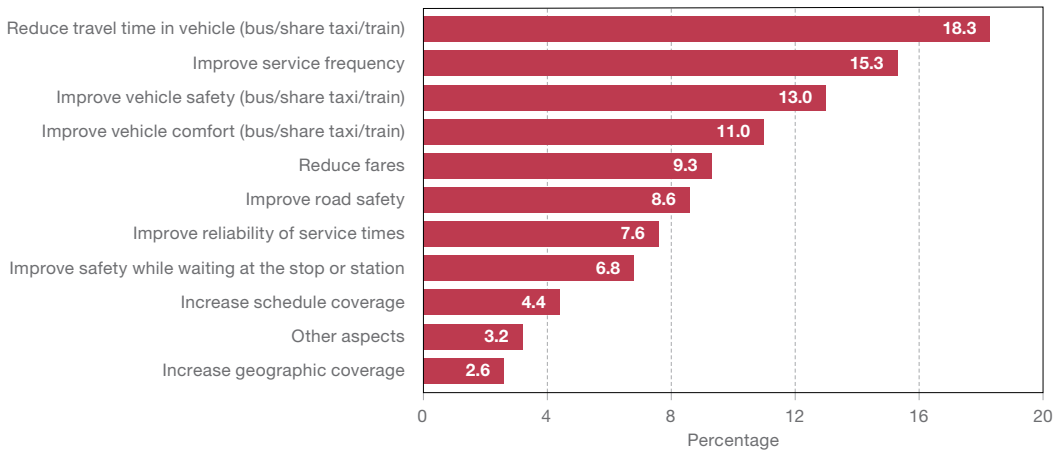
Graph 3.4 Level of dissatisfaction with public transport for 11 Latin American cities [a/ b/]



a/ The graph is based on the following question: "On a scale of 1 to 10, where 1 is 'not at all satisfied' and 10 is 'totally satisfied', how satisfied are you with the public transport in your city?". Respondents who gave a score of less than or equal to 3 on this question are considered to be "dissatisfied".
b/ The sample does not include households located in slums.

Source: Authors' elaboration using data from the 2016 CAF Survey (CAF, 2016).

Graph 3.5 Main aspects requiring improvement of public transport systems for 11 Latin American cities [a/ b/]



a/ The graph displays the response to the question: "Which aspect of the public transport system in your city do you think most requires improvement?". The average percentage of respondents who selected each option as the main aspect to be improved is shown..
b/ The sample does not include households located in slums.

Source: Authors' elaboration using data from the 2016 CAF Survey (CAF, 2016).

Text box 3.3 Women: Harassment on public transport

Women face an additional barrier to access for public transport; sexual harassment and physical violence. According to the 2016 CAF Survey, 16% of women in Latin America declared that they have been victims of some type of sexual or physical aggression on public transport (this figure reaches 19% among those who travel to work by public transport on a daily basis).[a] The scale of the problem varies considerably by country. Quito, Mexico City and Sao Paulo are the cities with the highest percentage of female public transport users who declare that they have been victims of physical aggression or sexual harassment (27%, 24% and 22% respectively), while Buenos Aires (11%), Fortaleza (12%) and Montevideo (12%) have the lowest percentage. As shown by the statistical analysis provided in Graph 3.6 having been a victim of some type of aggression or harassment is negatively related to perceptions regarding the quality of public transport. The problem is exacerbated by the fact that women use this service with greater frequency to travel to work. According to the 2016 CAF Survey, 63% of women in the region travel on shared public transport to their place of work, compared to 56% of men.

Women have the right to travel safely around cities. Restricting this possibility also limits their ability to access the opportunities that cities offer.

a. The cities included in this analysis are: Buenos Aires, La Paz, Fortaleza, Sao Paulo, Bogota, Quito, Mexico City, Lima and Montevideo.

On the other hand, Graph 3.6 presents information regarding the factors related to individuals and the transport system itself that are associated with the perception of quality among users, based on data provided by the 2016 CAF Survey. Among the individual characteristics that have been explored, only the condition of having a university degree is associated with a lower perception of the quality of public transport, while age and gender are not related to quality perceptions.[20] The correlations between public transport system performance and the perception of its quality were significant and its results were as expected. In this sense, those who answer that they "have poor access to jobs", or who state that they have suffered sexual harassment usually evaluate the quality of the system less positively. Similarly, those who suffer from high levels of traffic congestion or spend a greater amount of money on transport also tend to have a less favorable opinion of the public transport system.[21]

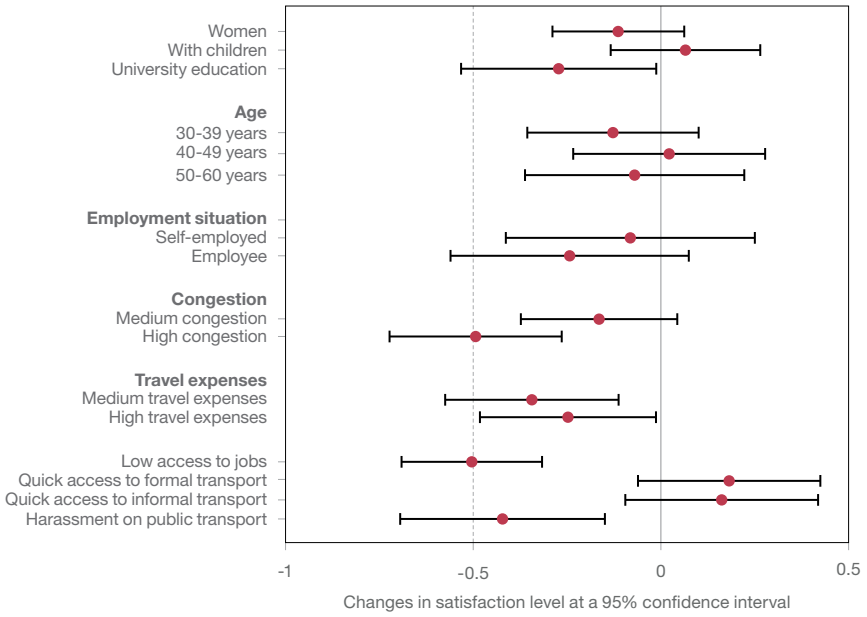
Dissatisfaction with public transport appears to be greater in Latin America than in the rest of the world, at least with regard to some means of transport. The BRTData.org portal provides comparisons for user satisfaction (specifically, for bus rapid transit, or BRT, systems) in 200 cities around the world, of which

20. The variable gender has a negative coefficient, but is not statistically significant when controlling for the variable that indicates that someone has suffered "sexual harassment".

21. The people who spend most within a country possibly undertake longer journeys and/or more transfers, and as such may be more exposed to deficiencies in public transport, including poor intermodal integration.

67 are in Latin America. It can be observed here that, on average, one in two users in the region describes the public transport system as "regular", while in the rest of the world, these systems are categorized as "good" or excellent". This dissatisfaction is closely linked with quality. Indeed, the average age of buses seems to be greater in Latin American systems. The average age of regular buses (standard fleets) in the region is 5.13 years, more than double the average age of the European fleet and slightly greater than the fleet in North American systems. A similar situation can be observed with the fleet of articulated buses.[22]

Graph 3.6 Determinants of public transport satisfaction for 11 Latin American cities [a/ b/]



a/ The graph displays the coefficients and 95% confidence intervals, estimated by ordinary least squares with robust standard errors. The dependent variable is ordinal, and corresponds to the question: "On a scale of 1 to 10, where 1 is 'not at all satisfied' and 10 is 'totally satisfied', how satisfied are you with the public transport system in your city?" The horizontal axis display changes in satisfaction levels depending on the prevalence of various demographic factors, the level congestion and other system characteristics. The regression controls for three measures of satisfaction (life, housing and neighborhood). City fixed effects are included. The "Congestion" and "Travel expenses" variables were recoded in three categories (low, medium and high) based on distribution terciles for each city in the sample. The coefficients displayed in the graph must be interpreted in relation to the base category, which for both variables is "low". For the "Employment situation" variable, the base category is "unemployed", and for the "Age" variable, the base category is "20 to 29 years"..
b/ The sample does not include households located in slums.

Source: Authors' elaboration using data from the 2016 CAF Survey (CAF, 2016).

22. Regular buses are normally 12 meters long, with one or two doors and an approximate capacity of 80 passengers. Meanwhile, articulated buses are 18 meters long, with three doors, an articulation and an approximate capacity of 170 passengers.

Improving the quality of public transport in Latin America is a priority objective for public policies. To achieve this, integration and formalization are key tools.

A desirable characteristic of BRT systems is integration with other modes of transport in the city. Unfortunately, while integration appears to be almost universal in Europe and North America, only one third of systems in Latin America include intermodal integration. A lower frequency of "real-time information" can also be observed in the stations of systems in Latin America compared to other regions. However, in areas such as the average distance between stations or operating speed, there are no differences between BRT systems in the region and other locations.

In conclusion, improving the quality of public transport in Latin America should be a priority objective for public policies. As will be analyzed later, integration and formalization are two key instruments to achieve this.

Heading for work

For a city's inhabitants, the importance of the commute to work is significant amongst all other trips performed within the city. According to the 2016 CAF Survey, workers in the region spend, on average, 40 minutes on a one-way commute. That is, the average Latin American spends approximately 1 hour and 20 minutes per day traveling to and from work. As is the case of all averages, this figure conceals significant variations between cities in the region. Graph 3.7 shows the average one-way commute time for cities in the region included in the 2016 CAF Survey. In the graph, it can be observed that the city with the lowest average commute time is Montevideo (29 minutes), and the city with the highest average commute time is Bogota (54 minutes).

Graph 3.7 Average and 75th percentile commute times for 11 Latin American cities [a/]

a/ The graph displays the average and 75th percentile of reported travel times from home to main place of work, based on the following question: "Approximately how long does it take you to travel from the front door of your home to the entrance to your main place of work?" The sample includes households in formal settlements and slums, and is limited to individuals who work outside of their home.

Source: Authors' elaboration using data from the 2016 CAF Survey (CAF, 2016).

People who travel by public transport tend to spend more time commuting.

Analyzing the time used to travel from home to work by the people who spend the most time on this trip may provide interesting information. Thus, Graph 3.7 also displays the distribution of time spent traveling from home to work for the 75th percentile. The 75th percentile indicates the minimum commute time for the 25% of the population that require the most time to go to work. The average for the 75th percentile in the region is 53 minutes per journey (without weighing for population size). In cities such as Sao Paulo, Bogota, Quito, Mexico City, Panama City and Lima, the 25% of workers who require the most time to travel from their homes to work spend altogether more than two hours per day commuting. This is a similar figure to that observed for New York City (Duranton and Guerra, 2016).

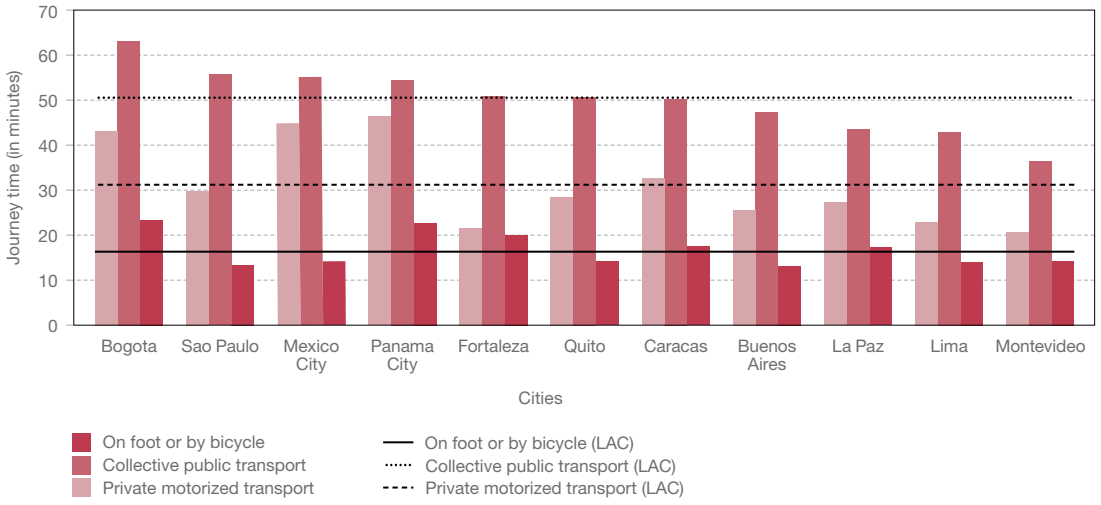
Graph 3.8 (see p. 138) shows how the time spent traveling to work varies depending on the means of transport used. People who travel by public transport tend to spend the most time commuting, followed by those who use cars or motorcycles, and finally those who travel exclusively on foot or by bicycle. The average journey to work throughout the region (without adjusting for city population size) takes 50 minutes on public transport, 31 minutes by car or motorcycle, and 16 minutes on foot or by bicycle (one way only in all cases).[23]

The differences in average travel time by means of transport may be due to disparities in travel speed or distance traveled. According to an exercise conducted based on the 2016 CAF Survey, travel speed by car (at peak time) is slightly higher than public transport, while both alternatives are faster than walking.[24] Meanwhile, Graph 3.9 (see p. 138) shows the different patterns of distance traveled by means of transport. While in Buenos Aires, Mexico City and Montevideo, people who travel by car tend to cover greater distances than those who use public transport, in Fortaleza, the opposite is true. In accordance with the conceptual framework established in Chapter 2, the first scenario concurs with a monocentric city model (with more affluent suburbs), and the second is compatible with a model in which there may be more than one business center and less residential segregation by socioeconomic status.

23. With regard to the means of transport used for commuting to work in cities included in the 2016 CAF Survey, public transport, car and travel exclusively on foot account for the majority of these journeys (90%), which concurs with the description provided for overall travel (regardless of the purpose of the journey) based on UMO data.

24. Average travel speeds (at 9 am) in Buenos Aires, Fortaleza, Mexico City and Montevideo were obtained based on the geolocation of respondents' homes and places of work, and the consultation of route characteristics using the Google Maps service. Information is subsequently provided on how travel speed by car varies throughout the day (see Graph 3.12, p. 143).

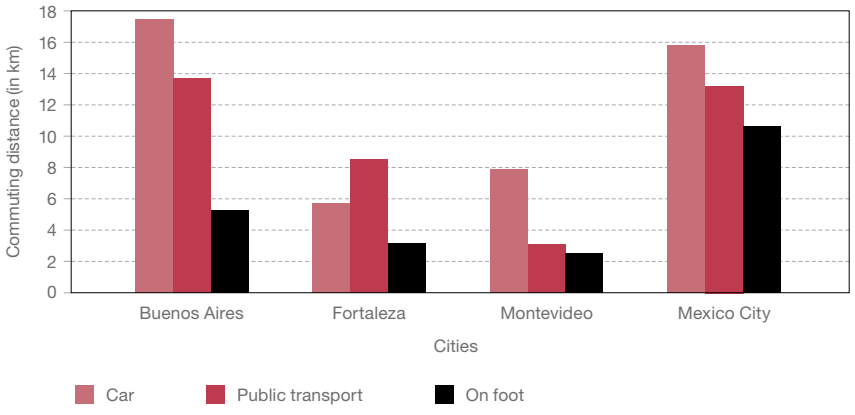
Graph 3.8 Average travel time by means of transport for 11 Latin American cities [a/]



a/ The graph displays the average travel time by means of transport. The horizontal lines represent the simple average of Latin American commuting times (without weighting for population) using each means of transport. The sample includes households in formal settlements and slums, and is limited to individuals who work outside of the home.

Source: Authors' elaboration using data from the 2016 CAF Survey (CAF, 2016).

Graph 3.9 Average commuting distance for several Latin American cities [a/]



a/ The average commuting distance was estimated based on origin-destination data obtained from the 2016 CAF Survey using the Google Maps program. Travel distance was calculated from Monday to Friday at 9 am. In the case of Montevideo and Fortaleza, the survey was implemented between April 17-21, 2016. For Buenos Aires and Mexico City, it was implemented between April 24-28, 2016. Journeys by car, motorcycle and public transport of less than 500 meters were excluded from the analysis.
b/ The sample included households in formal settlements and slums, and was limited to individuals who work outside of their home.

Source: Authors' elaboration based on data from the 2016 CAF Survey (CAF, 2016), and Google Maps queries.

The costs of urban mobility

Private expenditure

The lack of access to public transport may result in lower access to employment, social services and amenities for lower-income population sectors.

The importance of transport can be seen in the high amount of resources spent by households to move around the city. The total cost of transport for households is comprised by both money and the time required to travel from one place to another. Based on data from 27 countries and the sum of these two items, Schafer (2000) estimates that the total cost of transport for households is, on average, equivalent to around 10% of a country's gross domestic product.

In the United States, average household spending on transport is equivalent to 17% of their total income. In Europe that figure is between 10% and 20%, depending on the country (Redding and Turner, 2015). This is a good reference range for average spending on transport in most high-income and middle-income countries. In low-income countries, however, households tend to spend less on transport in terms of income (Díaz-Olvera et al., 2008).

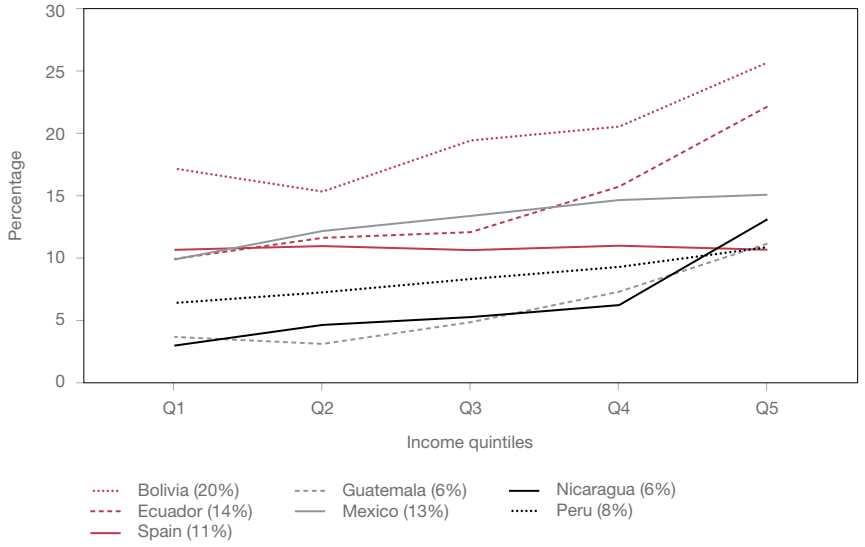
Graph 3.10 (see p. 140) displays the average spending on transport of urban households from six Latin American countries, with figures estimated based on data from national household income and expenditure surveys, and also includes Spain as a reference. The figures, as a percentage of household income, vary between 5% (for Guatemala) and 13% (for Mexico). Behind these averages, there are significant differences within countries according to household income. Expenditure on transport increases with household income. That is, higher-income households spend more on transport than lower-income households.[25] This happens because higher-income households travel more by car (which is more expensive), while lower-income households turn to public transport and walking. Furthermore, higher-income households tend to travel more frequently (Vasconcellos, 2010). In contrast, in high-income countries, household expenditure on transport does not increase together with household income levels. For example, in Spain, the proportion of household expenditure on transport is similar across the income distribution (see Graph 3.10, p. 140). Something similar happens in the United States (United States Department of Transportation, 2015).

One way for lower-income households to reduce spending on transport is by limiting the number of trips that they make. If the lower-income population spends relatively little on transport because the price of public transport is very high compared to their payment capacity, this stylized fact may be cause for concern. If this is the case, the lack of access to public transport may translate into lower access to employment, social services and amenities for this population sector. Carruthers et al. (2005) estimate a public transport accessibility index for a group of 27 cities and find that, indeed, public transport prices in the five cities from the region that are included in the study are high

25. Gallego and Ramírez (2012) document a similar pattern in Colombia.

compared to the average income of the lower quartile of their inhabitants (the 25% of the population with the lowest income).[26] Together, this evidence suggests that mobility is a luxury good in countries in the region (at least in monetary terms).

Graph 3.10 Household transport expenditure as a percentage of total spending by income quintile for several Latin American countries and Spain [a/]



a/ The graph displays the percentage of urban household transport expenditure, by income quintile. The data correspond to 2014 for Bolivia, Ecuador, Guatemala, Mexico and Nicaragua; and 2015 for Peru and Spain. The figures in brackets represent average transport expenditure as a percentage of total spending for each country.

Source: Authors' elaboration based on CEDLAS (2017).

However, it is important to highlight that the aforementioned expenditure pattern (where higher-income households spend more on transport than lower-income households) differs from what is generally observed in mobility surveys in the region. These studies tend to find that transport expenditure as a proportion of total expenditure drops with increased income. In that regard, it should be considered that the characteristics of transportation surveys do not enable these figures to be estimated appropriately, as the objective of such surveys is not to obtain a precise measurement of household income and expenditure, but rather urban travel patterns. These surveys usually measure household income levels based on a single question, which favors the underestimation of income levels among lower-income population sectors, who tend to have a complex income profile (with more than one

26. The cities included in the study are Buenos Aires, Brasilia, Río de Janeiro, Sao Paulo and Mexico City.

source of income, lower amounts, and more sporadic). Similarly, these surveys do not necessarily include all transport expenditure items, especially for private vehicles.[27]

Time lost in traffic jams reduces the population's productivity and quality of life.

In addition to monetary costs, transportation occupies a significant amount of the time available to households, as described in the "Heading for work" subsection. Similarly, transportation generates additional costs, other than the amounts paid by households in order for their members to travel. These are the social costs of transportation, which are listed below.

The social costs of transportation

As explained in Chapter 1, cities are torn between the benefits derived from agglomeration economies and the costs originating from congestion forces. The social costs of mobility include traffic congestion, as well as environmental pollution and road safety issues, which are the result of the use of motorized transport and, primarily, private cars.

Traffic congestion

Traffic congestion appears to be part of daily life in large cities, an issue which, due to the growing motorization of urban mobility, may continue to escalate. In the United States, it is estimated that the time lost by drivers due to urban traffic has doubled in the last three decades (Winston, 2013).[28] Although this type of measurement over time does not exist for Latin America, one only needs to picture cities such as Sao Paulo, Bogota, Mexico City or Lima to understand that, at the very least, traffic congestion is a major problem.

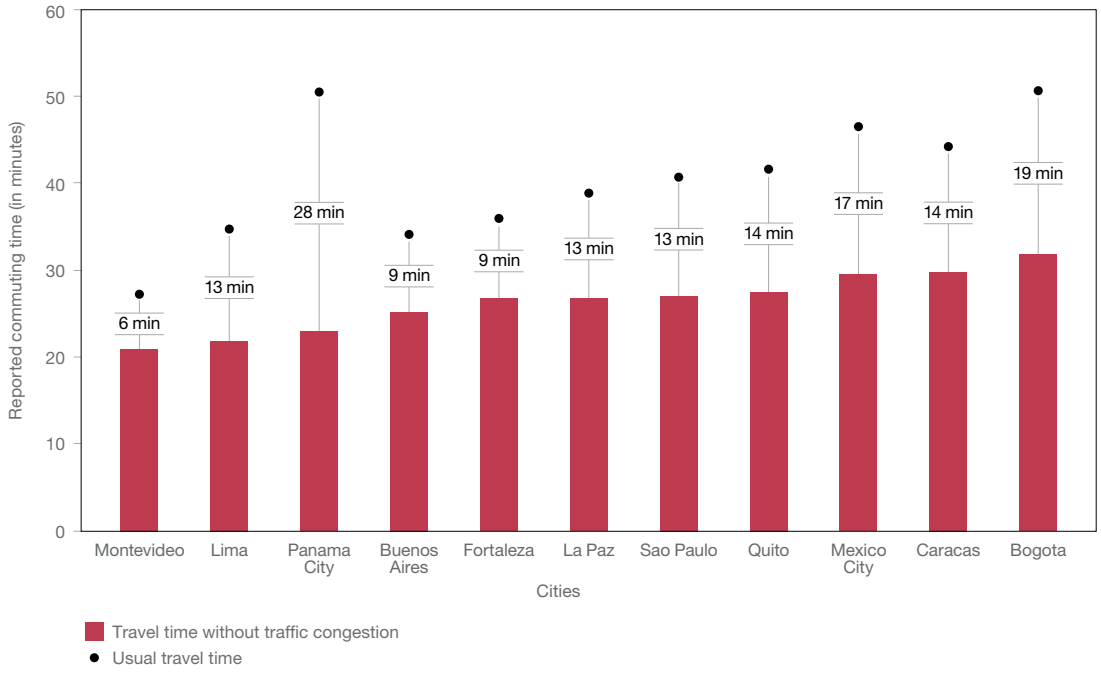
Traffic congestion causes economic losses because of the increased amount of time spent by the population on urban travel, the rise in transportation costs and the distribution of goods and services, and the increase in the amount of pollutants emitted by motorized vehicles. The former refers to the time spent by the population in traffic jams, reducing productivity and quality of life. This is time that could otherwise be used to work, study, partake in recreational activities or rest. In addition, the stress and discomfort associated with traffic congestion represent another negative impact, albeit one that is difficult to quantify. The second factor is related to the fact that traffic congestion increases transportation costs for firms, as it increases the amount of time required to transport goods. This, in turn, impacts on the productivity of firms and, ultimately, on aggregate economic performance. Finally, traffic jams impact on the environment both because motorized vehicles spend more time on the roads, and because

27. For example, categories such as the use, maintenance and purchase of vehicles are frequently omitted, which leads transport expenditure among higher-income population sectors to be underestimated.

28. According to the Texas A&M Transportation Institute's Urban Mobility Report, the annual cost of traffic congestion in the United States is more than USD 100 billion (Winston, 2013).

they emit a higher amount of pollutants when circulating at lower speeds (Vasconcellos, 2010).

Graph 3.11 Subjective congestion levels for 11 Latin American cities [a/ b/]



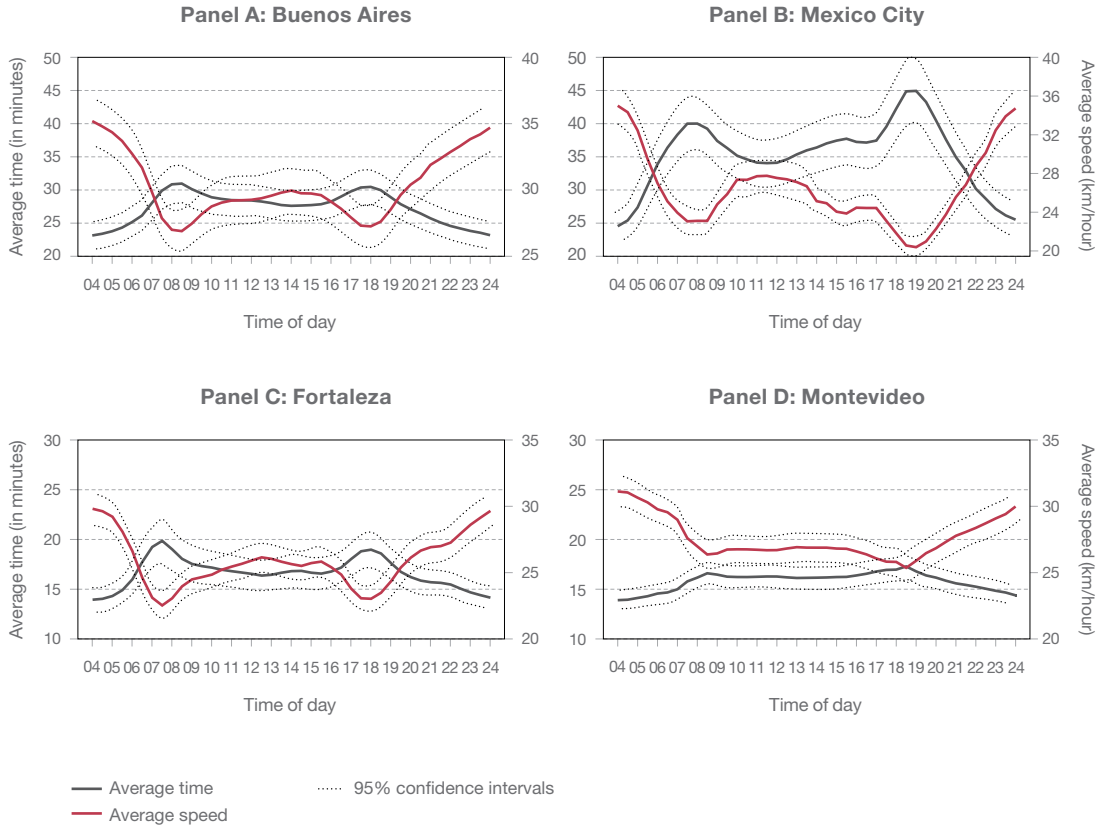
a/ The graph is based on the questions: "Approximately how long does it take you to travel from the front door of your home to the entrance to your main place of work?", and "How long would it take you to complete the journey mentioned in the previous question without traffic congestion?"
b/ The bars represent the average amount of time that respondents believe they would require to commute to work if there was no congestion in the city. Meanwhile, the points above each bar show the average amount of time that they actually require to complete this journey. The figures provided in horizontal lines display the difference between the two. The sample includes households in formal settlements and slums, and is limited to individuals who work outside of their home.

Source: Authors' elaboration using data from the 2016 CAF Survey (CAF, 2016).

The 2016 CAF Survey gathered information on the amount of time that people who travel in motorized vehicles say they normally require to commute from home to work, and inquired about how long they believe it would take them to complete the same trip without any traffic. These two questions can elicit a measure of subjective traffic congestion, or the average additional travel time produced by traffic congestion in a city. In Graph 3.11, which displays the results of this exercise, it can be observed that, on average, Latin Americans estimate that they travel for 14 minutes longer in each trip to work due to traffic, amounting to a 58% increase in commute times. As expected, there are significant differences between cities. For example, while the inhabitants of Bogota and Panama City travel, on average, around 19 minutes to 28 minutes longer per journey due to traffic, this figure is only 6 minutes in Montevideo, although trips in this city are generally shorter.

In addition to the above, Graph 3.12 shows how the time and average travel speed by car varies throughout the day for four cities included in the 2016 CAF Survey. To achieve this, the Google Maps tool was used to estimate travel times at different times of day (over the course of the week) for respondents' work commutes. Predictably, the time of day has an impact on journey duration. Work commutes are much shorter at 4:00am (when fewer people are commuting) than at 8:00am or 9:00am. After this period, journey time improves throughout the day, before slowing down again towards the end of the afternoon (when most of the population returns home from work). The difference between journey durations at peak time and 4:00am may be interpreted as a measure of the cost of congestion in terms of time.

Graph 3.12 Average travel speed and time by car for selected Latin American cities [a/ b/]



a/ Journeys between home and work are estimated based on the 2016 CAF Survey, using the Google Maps program for transport by car during one week at half-hour intervals between 04:00 and 24:00. In the case of Fortaleza and Montevideo, the survey was implemented between April 17-21, 2016. For Buenos Aires and Mexico City, it was implemented between April 24-28, 2016. Journeys of less than 500 meters were excluded from the analysis.
b/ The sample includes households in formal settlements and slums. It is limited to individuals who work outside of their home, and travel by car or motorcycle.

Source: Authors' elaboration based on data from the 2016 CAF Survey (CAF, 2016), and Google Maps queries.

In most Latin American cities, air pollution levels exceed the recommended WHO standards.

The measurement of costs associated with traffic congestion implies several challenges. As mentioned earlier, the majority of these studies measure time lost by commuters due to the increase in vehicle flow. This approach, however, overlooks other externalities of traffic congestion (for example, environmental deterioration), and ignores the costs faced by those who change their travel patterns due to congestion, for example, by leaving home at a different time, or forgoing their trip altogether. In addition, it implicitly assumes that most people could travel without generating congestion, which is unfeasible. Similarly, most of these studies focus on vehicle circulation patterns for a small group of streets within a city. This is unsatisfactory, because it disregards the possibility that commuters may take alternative routes to reach the same destination.

Akbar and Duranton (2017) used the Bogota transportation survey to study the social cost of traffic congestion in this city. As part of the study, they used Google Maps data to calculate travel times at different times of day and on several days in the week for all trips registered in the survey. This counterfactual information is used to estimate the speed variation of each journey according to traffic density (which changes depending on the day and time), as well as how the total traveled distance varies as travel speed decreases. The authors of this study found that: i) the total traveled distance increases by between 1.2% and 1.8% when the average travel speed increases by 1%; and ii) average travel speed decreases by 0.06% when traffic density increases by 1%.

The first result implies that citizens of Bogota travel more when traffic circulation speed is faster, as could be expected. The second result indicates, somewhat surprisingly, that the increase in vehicle flow has a minimal impact on average travel speed. That is, the marginal social cost of congestion (i.e. the impact of an additional vehicle entering the route on the circulation speed of remaining vehicles) is very low. However, this does not mean that there is no traffic in Bogota, and that it is possible to travel rapidly from one point to another in the city. On the contrary, it concurs with the thesis that traffic congestion in cities such as the Colombian capital is so extensive (probably due to the lack of existing road infrastructure, which is scarce compared to the population size) that even at non-peak times, circulation speed remains low.

A similar finding is reported in Graph 3.12 (see p. 143). Except during the early morning, when vehicle traffic is practically nonexistent, circulation speed throughout the day is very slow. This is even more conspicuous when looking at journeys by car, which in theory is the fastest means of transport. In other words, rush hour lasts all day.

Environmental pollution

One of the most negative consequences of the use of motorized transport is its contribution to poor air quality in cities in the region. In this sense, it should be noted that in most Latin American cities, air pollutant levels alarmingly exceed

the standards recommended by international bodies such as the World Health Organization (WHO, see Text box 3.4).

Text box 3.4 Polluted cities in Latin America

Due to its harmful impact on health, many countries regularly monitor pollution levels in cities. The WHO's Urban Ambient Air Pollution Database collects two measures of environmental pollution, PM10 and PM2.5, for almost 3,000 cities in 103 countries around the world for the 2008-15 period (129 of these cities are in Latin America). PM10 measures the amount of particulate matter dispersed in the atmosphere whose diameter is less than or equal to 10 microns, while PM2.5 measures suspended particulate matter in the atmosphere with a diameter of less than 2.5 microns. Due to their size, these particles are able to enter the human respiratory system.

According to this database, the average annual level of PM10 is above the limits recommended by the WHO in 58% of the world's cities. Meanwhile, the average annual level of PM2.5 is above the recommended limits in 69% of the world's cities. For their part, in Latin American cities that conduct environmental pollution measurements, these percentages reach 92% and 90% respectively.

Vehicles that use gas or diesel engines produce polluting particles in the environment such as carbon oxides, nitrogen oxides, hydrocarbons and sulfur oxides. Some of these pollutants have a more significant global effect, while others are more harmful to local air quality. For example, carbon dioxide is a primary contributor to the greenhouse gas effect, and sulfur dioxides to acid rain. Meanwhile, carbon oxide reduces the amount of oxygen in the blood, and has negative cardiovascular effects, while nitrogen oxides and hydrocarbons are the most important components of smog, which affects respiratory functions in children and asthmatics, and reduces people's visibility (Parry et al., 2007).

Pollution is particularly concerning due to its undesired effects on development during the first years of children's lives, and even during pregnancy, since at this stage good health is critical for the development and accumulation of skills throughout the entire lifecycle (CAF, 2016). In this sense, Text box 3.5 (see p. 146) describes a series of studies that provide rigorous measures of the impact that some of these pollutants have on human health. In addition to negative effects on the health of the population, pollution can also increase mortality rates (Graff Zivin and Neidell, 2013).

As seen earlier, motorized transport is one of the main sources of air pollution emissions, although its contribution varies by pollution type. For example, according to Arceo et al. (2015), in Mexico City in 1996, motorized vehicles produced 98% of total carbon dioxide emissions, 36% of particulate matter emissions and 21% of sulfur dioxide emissions. Similarly, according to UMO

data, private and public use of cars and motorcycles produces 74% of carbon dioxide emissions generated by the transport system in Latin American cities for which data is available (Vasconcellos and Mendonça, 2016). Most bus systems in Latin America still operate with diesel, which has a high particulate matter (PM) content. Although actions are being taken to migrate to more efficient and cleaner fleets, these efforts are incipient. On the other hand, the higher cost of these technologies has generated additional delays in their implementation.

The level of pollutant emissions depends on vehicle technology and fuel quality. Technology can reduce the contribution of vehicles to poor air quality in cities through improvements in pollutant emission rates (per liter of fuel used) or vehicle efficiency in fuel consumption per kilometer traveled (Parry et al., 2007). The catalytic converter is an example of a technology that reduces pollutant emissions. A vehicle equipped with a catalytic converter releases practically no carbon monoxide into the atmosphere. In that sense, it should be noted that during the last 30 years, pollutant emissions attributed to motorized vehicle use have fallen dramatically in the United States, despite the fact that the number of vehicle-kilometers traveled increased significantly during the same period. This reduction is associated with the implementation of more rigorous emission control standards for new vehicles, as well as the gradual outflow from the vehicle fleet of old vehicles equipped with highly-polluting technology (Parry et al., 2007).

In contrast, in developing countries, including those in Latin America, there is widespread concern regarding the possibility that air pollution will worsen as a result of the increase in industrialization rates and the use of motorized transport. However, not all news is bad. In Mexico City (renowned for its poor air quality), the concentration of pollutants in the atmosphere decreased by 23% for ozone and 48% for carbon monoxide between 1997 and 2006 (Arceo et al., 2015).

Text box 3.5 Effects of pollution on health, human capital and labor productivity

A series of recent studies rigorously demonstrate that exposure to high levels of pollution may shorten pregnancy, reduce children's birth weight and increase infant mortality, both in developed countries (where pollution levels tend to be lower) and in developing countries. For example, Currie et al. (2009), using data from the State of New Jersey, in the United States, found that babies exposed to high levels of carbon dioxide (CO_2) in utero have a lower gestational age and weigh less at birth than those exposed to lower pollution levels. The impacts of pollution are substantial. According to this study, relocating a pregnant woman from an area with high pollution levels to an area with low pollution levels would have a greater positive effect on the child's health than convincing a pregnant woman who smokes 10 cigarettes a day to stop smoking. In addition, exposure to high levels of CO_2 increases the risk of death among newborns by 2.5%.

Balsa et al. (2014) also demonstrate that high levels of PM10 reduce birth weight and increase the probability of premature birth in a study conducted with data from Montevideo, while Bharadwaj et al. (2014), using data from Santiago de Chile, find that primary school students who were exposed to lower levels of CO_2 during pregnancy perform better in educational standardized tests scores. Quantitatively, the impact of a reduction of one standard deviation in CO exposure on educational performance is equivalent to a fifth of the impact generated by the most successful education policies that have been implemented in developing countries, designed specifically to improve educational performance.

Similarly, environmental pollution may affect adults' health and labor productivity. Hanna and Oliva (2015) found that the closure of a refinery in Mexico City, which took place in 1991, produced a reduction of 8% in the prevalence of sulfur dioxide in the air in nearby neighborhoods. Similarly, they estimate that an increase of 1% in the amount of sulfur dioxide in the air results in a reduction of 0.61% in the number of hours worked by individuals exposed to this pollutant.

Road safety

Urban transport is associated with a large number of accidents that result in injuries and fatalities. In Latin America, 720,000 people are injured and 93,000 killed every year as a result of road traffic accidents that occur within and outside urban areas, according to figures from the Ibero-American Road Safety Observatory (OISEVI, 2016). Due to underreporting, the real figures could be even higher, particularly for morbidity rates. In addition to the human cost due to loss of life, and the temporary and permanent health effects, traffic accidents reduce the resources available to the healthcare sector to treat other illnesses, imply a loss of labor productivity and cause material damage.

Traffic accidents affect certain population groups to a greater extent, above all young people and senior citizens, as well as pedestrians and motorcyclists, and are the main cause of death among young people aged 15 to 29 globally (PAHO, 2016). Similarly, in Latin America, the probability of a person aged 65 or over being fatally injured in a traffic accident is almost double compared to the rest of the population (OISEVI, 2016). On the other hand, around 80% traffic accident fatalities in the region correspond to pedestrians or people traveling by motorcycle when the accident occurs (Vasconcellos and Mendonça, 2016). This implies that the lack of road safety is a problem which affects lower-income population sectors to a greater extent, as they tend to walk and use motorcycles more prevalently as a means of transport (Duranton and Guerra, 2016).

Improving road safety forms part of the international cooperation agenda for development. In 2010, the General Assembly of the United Nations established the current decade as the Decade of Action for Road Safety, with

The average road traffic accident mortality rate in Latin America more than doubles the rate in Europe and North America.

the goal of reducing fatalities caused by traffic accidents on a global scale. The United Nations 2030 Agenda for Sustainable Development, approved in 2015, set the goal of halving the number of global deaths and injuries from road traffic accidents by 2030.

In developed countries, traffic accident fatalities have decreased significantly during the last 50 years. In the United States, for example, a country with high traffic accident mortality rates compared to the average for high-income nations, the mortality rate per 100 million vehicle-miles traveled fell from 5.1 fatalities in 1960 to 1.5 fatalities in 2003. This change is attributed to more widespread seatbelt use, improvements in automotive technology, a decrease in driving under the effects of alcohol, and a reduction in the number of pedestrians (Parry et al., 2007).

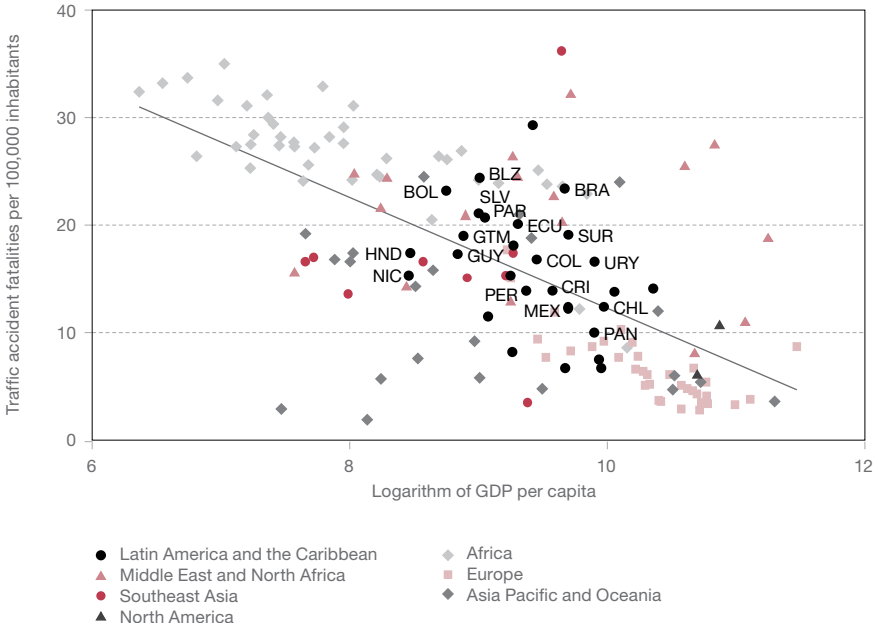
Studying the relationship between road traffic accidents and a country's income level may also provide useful insights. On one hand, the use of motorized transport increases with income levels, and it is foreseeable that an increase in the vehicle fleet would result in a greater risk of accidents. However, as a country's income level increases, other factors also change that favor a reduction in road traffic accidents and their consequences. This is the case with automobile technology, the quality and safer design of roads, the effectiveness of healthcare services and the existence of better institutions that promote compliance with the law (for example, speed limits). If the second effect is the stronger of the two, a negative relationship is likely to exist between road traffic accident fatalities and countries' per capita income. As shown in Graph 3.13, in the extent to which income increases, road traffic accident fatalities decrease.

According to OISEVI (2016) data, in 2014, the average road traffic accident mortality rate in Latin America was 17 fatalities per 100,000 inhabitants, more than double the rate in Europe (7 fatalities) and North America (8 fatalities).[29] However, between 2000 and 2014, most countries in the region experienced a reduction in the road traffic accident mortality rate, except for Paraguay (where the rate increased from 10 fatalities to 16 fatalities) and Brazil (where it increased from 17 fatalities to 20 fatalities).[30] The generalized reduction in road traffic accident mortality rates is good news for transport policies in Latin America, as it occurred despite the increase in the region's vehicle fleet.

29. These differences persist even when controlling for average income levels in the countries that make up these regions.

30. This improvement occurred even though the region continued to struggle against underreporting of traffic accidents during this period. As such, the magnitude of the improvement may be even greater than indicated by the figures.

Graph 3.13 Correlation between traffic accident fatalities and GDP per capita for several regions in 2013 [a/ b/]



a/ Te graph displays the correlation between traffic accident fatalities (per 100,000 inhabitants) and GDP per capita, PPP for 162 countries. GDP data were obtained from the World Bank, while traffic accident fatality rates were obtained from WHO.
b/ The tags correspond to the following Latin American countries: Belize (BLZ), Bolivia (BOL), Brazil (BRA), Chile (CHL), Colombia (COL), Costa Rica (CRI), Ecuador (ECU), El Salvador (SLV), Guatemala (GTM), Guyana (GUY), Honduras (HND), Mexico (MEX), Nicaragua (NIC), Panama (PAN), Paraguay (PAR), Peru (PER), Suriname (SUR), and Uruguay (URY).

Source: Authors' elaboration using data from WHO and World Bank.

Policies to improve mobility

Within the analytical framework of this chapter, it has been established that public policies can improve urban accessibility and, therefore, social wellbeing through improvements in mobility that minimize associated equity and efficiency issues. The efficiency issue arises from negative externalities generated by the use of motorized transport, the status of mobility infrastructure as a public good, and the coordination issues that constrain the operation of public transport. The equity issue is due to the fact that transport is considered a social good, as the ability to travel around a city predetermines access to employment, social services and amenities. That is, it predetermines the benefits of living in an urban area.

This section reviews a series of policies that affect urban mobility directly or indirectly. The policies studied are organized in three sets: i) regulations that

aim to counteract the externalities generated by individual motorized transport; ii) the provision of mobility infrastructure; and iii) actions that aim to improve public transport operation. The analysis is focused on how these policies can contribute to improving accessibility, taking into account the aforementioned equity and efficiency issues.

Regulating car use

As outlined previously, motorized transport, mainly of a private nature, produces extensive social costs in terms of traffic congestion, environmental pollution and road safety, among others. Similarly, Text box 3.1 (see p. 122) describes the microeconomic foundations of externalities as a social wellbeing issue, due to the gap between the private cost of an action (such as traveling by car) and its social cost (the increase in congestion, pollution and road safety risks generated by the additional vehicle). In the extent to which each driver who travels by car only considers their private cost (the time taken, and the value of gas consumed by the vehicle), the number of cars in circulation will be inefficiently high from a social viewpoint.

This is the basic argument of economists who have long advocated the introduction of a congestion tax as a mechanism to efficiently reduce this externality. The central idea of this proposal is to charge each person a tax according to their contribution to a city's traffic. If the size of the tax is equal to the difference between the private cost and social cost, each potential new driver will consider the tax when calculating whether they should travel by car. As such, eventually, only an efficient number of cars will be in circulation. That is, charging the tax would force those who travel by car to "internalize" the social costs generated by their journey. In that regard, it should be noted that the purpose of this policy is not to eliminate traffic congestion, but rather to reduce it to a level in which the social benefits and costs of car use are equal.

Congestion tax has gone from being an academic curiosity to being implemented in several cities in developed countries, such as London, Milan, Singapore and Stockholm. In practice, it consists of charging car users to travel at certain times of day in a specific area of the city (generally, business centers during the working day). In 2003, London pioneered the application of this tax, implementing a charge of £5 on private cars for traveling or parking on streets in the city center. There is a general consensus around the success of this experience, as it has led to significant reductions in traffic congestion (within and outside the city center), and greater use of public transport (which also benefited from an increase in available resources due to this tax collection). Today, the majority of Londoners support the measure (Leape, 2006).

In summary, congestion tax may potentially reduce traffic congestion, promote public transport use, reduce pollution and improve local government tax collection, which would enable the availability of resources

Congestion tax may potentially reduce traffic congestion, promote public transport use, reduce pollution and improve tax collection.

for improving mobility infrastructure to be increased. It is also a progressive tax, as it is paid by private car owners, who tend to come from above-average income households. However, as indicated by the experience of London, the implementation of this tax implies both technical and logistical challenges (for example, the installation of cameras and mailing of fines), as well as political challenges (for example, the opposition of large sectors of society; Leape, 2006). In perspective, congestion tax may be an attractive option in cities with high levels of traffic congestion, but that also have viable public transport alternatives and a high capacity to design and implement this type of program.

A prevalent alternative in Latin America is the adoption of driving restriction programs (such as Hoy No Circula in Mexico and Pico y Placa in Colombia and Ecuador). Cities such as Sao Paulo, Santiago de Chile, Bogota, San Jose, Quito and Mexico City have implemented this type of initiative with the explicit objective of reducing traffic congestion and environmental pollution. In its simplest modality, this scheme assigns each motorized vehicle a specific day of the week on which it cannot circulate, or can only do so partially (the day is defined by the vehicle license plate). In practice, these programs vary according to restrictions established based on vehicle type, area of the city or time of day. For example, in Mexico City, newer (and potentially less polluting) cars are exempt from this ban, while in Quito the restriction is limited to the city center.

Driving restriction programs are less challenging to implement, and tend to provoke less rejection in public opinion than the congestion tax. However, such programs have disadvantages which may well exceed their benefits. Firstly, due to their design, it is unlikely that these programs will reduce traffic congestion to an efficient level from a social viewpoint, as they restrict vehicle circulation regardless of their marginal contribution to traffic congestion and pollution, or the marginal benefit of their use.[31] Second, when this type of program is implemented for a prolonged period, it provides incentives that favor the growth of the vehicle fleet, which is an even more serious issue. In fact, a commonly used strategy by households to avoid the ban is to purchase an additional vehicle, enabling them to alternate use of one or other depending on which car is subject to the restriction on a specific day. Furthermore, these programs may have counterproductive effects on traffic congestion (if the households that purchase an additional vehicle make the same number of journeys in total as they did prior to the restriction) and on the environment (if the additional vehicle is more polluting).

Davis (2008) documents the way in which the Hoy No Circula program (launched in 1989) failed in its objective to improve air quality in Mexico City due to the fact that it led to an increase in the number of vehicles in

31. However, this effect may be lessened by limiting the implementation to the most congested areas (as in Quito), and to more polluting cars (as in Mexico City).

When implementing a congestion tax, it is essential to successfully communicate the features and benefits of this policy to the population.

circulation in the city, as well as the proportion of more polluting cars. The growth of the vehicle fleet was reflected in air quality deterioration during the weekends (when the Hoy No Circula program was not in operation), and in a reduction in public transport use.[32] Bonilla (2016) obtained similar results in his evaluation of the Pico y Placa program in Bogotá, with negative effects on air quality once the original restrictions imposed in 1998 were extended in 2009.[33]

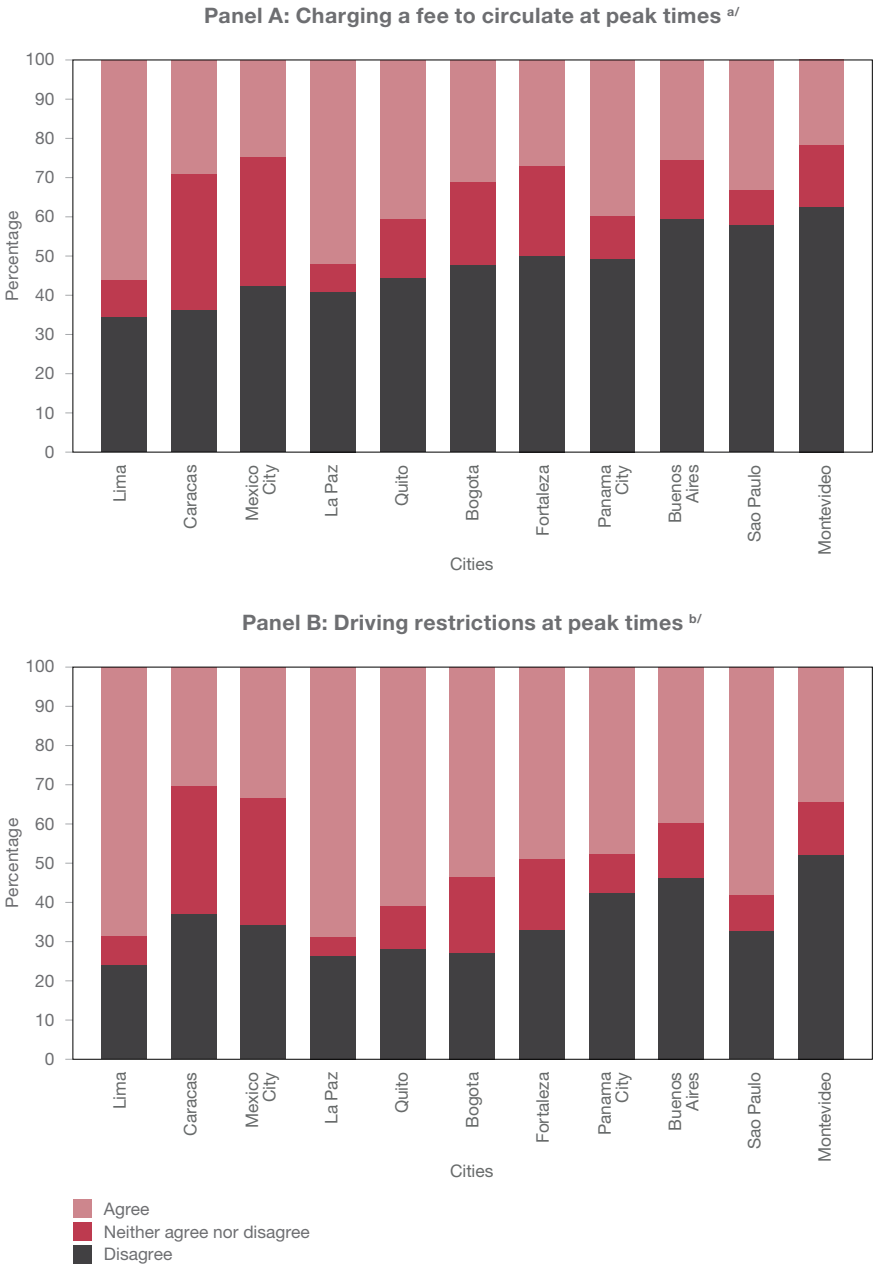
The 2016 CAF Survey investigated the extent to which inhabitants of 11 Latin American cities agree with each of the two policies discussed so far.[34] Graph 3.14 displays the results of this exercise for each city (panel A outlines support for the policy of charging fares for traveling at peak times, and panel B shows support for driving restrictions at those times). Variation between cities can be observed, and public opinion is divided regarding support for this type of initiative. For example, charging fares has a high degree of support in Lima, above 50%, while that figure reaches around 20% in Montevideo. This is not surprising given the differences in congestion levels in each city. However, in general, more support is observed for a hypothetical driving restriction program than for a congestion tax. This result can be explained by the fact that Latin Americans are more familiar with restriction policies than congestion tax. In any case, this evidence supports the argument that one of the essential tasks for any government interested in implementing a congestion tax is to successfully communicate the features and benefits of this policy to the population.

32. Gallego et al. (2013) found that environmental improvements generated by the Hoy No Circula program were only very short term (within a maximum of 12 months from the program launch), before giving rise to the negative effects described by Davis (2008). This is due to the fact that households' reaction is not immediate, as the purchase of an additional vehicle requires a certain amount of time.

33. Carrillo et al. (2016) found that the Pico y Placa program had a positive effect on air quality in Quito. However, it is important to consider that this program was in the provisional stage during the evaluation period, with periodic and unexpected extensions to its duration. It remains to be seen whether it will obtain similar results when operating as a permanent policy. Likewise, it should be noted that the local government had to dedicate significant police resources to guaranteeing compliance with the driving restrictions established by the Pico y Placa program. In this sense, it should also be considered whether these surveillance tasks may have an effect on other areas of public safety. In fact, Carrillo et al. (2016) found an increase in crime rates in Quito as a result of the implementation of this program.

34. Specifically, it asked about congestion charges for traveling at peak times, and driving restrictions in the city center at peak times.

Graph 3.14 Level of agreement with policies to regulate private car use at peak times for 11 Latin American cities



a/ The graph is based on the following question: "To what extent do you agree with charging a fee for private cars to travel at peak times, if it would help to reduce traffic?"
b/ The graph is based on the following question: "To what extent do you agree with authorities partially restricting private car use in the city center during peak times, if it would help to reduce traffic?"

Source: Authors' elaboration using data from the 2016 CAF Survey (CAF, 2016).

Congestion tax and driving restrictions share a central element: both policies increase the cost of private motorized vehicles. As has been indicated previously, this principle makes sense from a social viewpoint, given the gap that exists between the private cost and social cost of car use (which gives rise to the externalities that have been described). Therefore, a good guide for evaluating urban mobility policies is to evaluate the extent to which they contribute to car users considering the total cost (private cost plus social cost) of using their vehicle. That is, the extent to which they internalize the externality. On the other hand, there are two instruments in addition to those that we have already examined which local governments can use to achieve this objective; parking policies on public roads (and in private parking lots, when prices are regulated), and urban freeway access policies (overpasses, ring-roads, etc.). Although car users have traditionally had access to these services without making a marginal payment, in recent years, the introduction of parking meters and urban tolls has been extended in several of the region's cities. As these mechanisms may reduce the gap between the private cost and social cost of motorized transport, their design should ideally follow the principles outlined for the congestion charge; targeting areas and times with heavy traffic, and allocating the financial resources collected to a clear objective that increases social wellbeing (as occurs with the promotion of public transport in the case of London). Along the same lines, it is possible to implement a fee based on the number of seats occupied within vehicles, charging private vehicles with one or two passengers (as is the case for the majority) differently to those that have three or more passengers. In this way, incentives are provided for maximizing the use of the installed capacity, both in terms of infrastructure and vehicles.

As with congestion tax, the aim of this measure is for car users to internalize social costs. Similar alternatives, such as charging each person according to their contribution to environmental pollution, could also be considered. However, this scheme implies even greater implementation challenges than the congestion tax as, first, measuring the amount of pollutant emissions generated by each car in a specific period is unfeasible. However, as fuel consumption is closely related to pollutant emissions, one option may be to apply a fuel tax. This tax is easy to collect, difficult to evade, and of a progressive nature, as car use is more common among higher-income households. Nevertheless, the adoption of this type of tax is not without difficulties. For example, if it is only implemented locally, as opposed to country-wide, vehicle owners may have incentives to fill up with gas in neighboring municipalities that are exempt from the tax, and the policy's benefits would be lost. Even so, a large number of countries charge fuel tax due to its advantages as an efficient tax collection instrument on a national level.[35]

35. Similarly, there are countries that, by subsidizing fuel, generate environmental, tax and traffic congestion distortions, in accordance with the logic described above (that is, they increase the size of transport externalities). Venezuela is a current example of this in the region.

Other feasible public policy initiatives that could be applied include fuel quality and emissions standards for new vehicles. In India, for example, the obligatory installation of catalytic converters is associated with significant improvements in air quality within five years after the policy was launched (Greenstone and Hanna, 2014). Meanwhile, in the United States, the perfecting of emissions technology is considered to be a key factor in the marked reduction of environmental pollutants produced by cars in the country (Parry et al., 2007).

One alternative to reduce car use is to apply measures such as work schedule regulations and promotion of teleworking.

Similarly, the lack of maintenance and aging of vehicles in circulation increases the amount of pollutant emissions per kilometer traveled. One way of regulating this problem (in this case, indirectly) is to implement periodic and obligatory vehicle emissions reviews. However, this type of inspection may be subject to manipulations, particularly in weak institutional contexts, such as those in Latin America. In this sense, Oliva (2015) estimates that around 10% of private vehicle owners in Mexico City have paid bribes to fraudulently pass a vehicle emissions inspection.

Another measure that aims to increase the private cost of car use in order to reduce the associated externalities is vehicle ownership taxes, which have the advantage of being easy to implement and difficult to evade, making them an attractive tax collection instrument. For the aforementioned reasons, this is also a progressive tax. However, it must be taken into account that, in conceptual terms, this alternative is not as efficient as the congestion tax, as it penalizes ownership and not the vehicle's contribution to traffic congestion and pollution. The design of a vehicle tax with an explicit environmental (and not just collection) objective should apply a higher rate to potentially more polluting vehicles.

Finally, an alternative to the policies analyzed so far is to attempt to reduce car use indirectly; for example, through employment policies such as the regulation of working hours and promotion of teleworking (remote work). The concept of regulating working days consists of staggering employee start and end times to reduce congestion caused by the clustering of these schedules at specific points in the day. However, these policies have significant disadvantages that must be considered, particularly because they may lead to negative results in labor productivity. As discussed in Chapter 1, agglomeration economies flourish when people can work together. "Staggered" working days and teleworking both have effects on productivity, which vary by job type and firm characteristics. Firms in which the interaction between employees is not essential for productivity (such as a call center) may choose to adopt these initiatives without the need for public intervention. But firms that depend on this interaction to a high degree (such as an assembly line) may be adversely affected if the State obliges them to adopt such strategies.

Mobility infrastructure

Mobility depends on the available infrastructure (streets, sidewalks, bridges, bicycle lanes, etc.). However, infrastructure is limited as it requires the investment of public resources and because it uses a scarce good in cities: space. The allocation of space in cities to multiple uses is a central topic in urban planning. Within this framework, relevant questions include: how much space should a city dedicate to mobility infrastructure? How much space should be allocated to appropriate infrastructure for each mobility option? Where in the city should infrastructure investments be made? As is the case for the aforementioned policies, the answers to these questions have efficiency and equity implications because they affect mobility costs and, therefore, individuals' mobility patterns, the residential distribution of households, and the city's size and layout.

Information on the size and scope of mobility infrastructure in Latin America, as well as its quality and use, is limited. One significant contribution to reducing this deficit is CAF's UMO. Based on information from the observatory, Table 3.1 displays data on existing road infrastructure in some of the region's cities. This includes kilometers of roads per inhabitant, the number of intersections with traffic lights per 100 km, the percentage of public transport lanes and the percentage of bicycle lanes. As can be observed, the indicators show significant heterogeneity between the cities studied.

In terms of kilometers of roads per 10,000 inhabitants, around 90% of cities have at least 30 km. Medellin has the lowest figure (5 km), while Florianopolis has the highest (40 km). The number of intersections with traffic lights per 100 km of roads is a significant variable, as it provides indirect information on the type of routes that are most prevalent in a city. Indeed, traffic lights are more common on local streets and medium-sized avenues than highways and expressways. This indicator varies from around 3 traffic lights per 100 km in Santa Cruz de la Sierra (Bolivia) to around 34 traffic lights per 100 km in Medellin. For its part, the percentage of roads with priority lanes for public transport varies from practically 0% in Florianopolis, Manaus, Monteria and San Jose to around 3% in Pereira. For bicycle lanes, that figure varies from 0% in Barranquilla (Colombia) to almost 9% of roads in Brasilia.

It should be noted that not even the highest figures in the different variables are close to average infrastructure figures in developed countries. In a study conducted on the 50 largest metropolitan areas in the United States, Levinson (2012) found that kilometers of roads per 10,000 inhabitants vary between 51 km and 71 km depending on the population of each city. These figures are above the leading city in the UMO sample for Latin America (Florianopolis).

Table 3.1 Road infrastructure for several Latin American cities

Country	City	Inhabitants per urban km²	Kilometers of road per 10,000 inhabitants	Traffic lights per 100 km	Routes with priority collective transport lanes as a percentage of total routes (%)	Routes with priority bicycle lanes as a percentage of total routes (%)
Argentina	Buenos Aires	4,061	28.5	13.5	0.2	0.3
	Rosario	8,808	19.0	32.0	0.4	4.1
Bolivia	Santa Cruz de la Sierra	3,933	25.2	3.2	0.3	0.3
Brazil	Belo Horizonte	9,303	25.8	9.7	0.3	0.5
	Brasilia	11,364	17.5	20.5	1.8	8.8
	Curitiba	8,033	25.2	15.2	1.0	2.1
	Floranopolis	8,369	39.6	4.0	0.0	1.5
	Manaus	2,331	20.6	13.9	0.0	0.1
	Porto Alegre	9,589	23.8	19.2	0.6	0.3
	Recife	4,621	22.9	9.8	0.1	0.1
	Rio de Janeiro	13,507	12.6	20.6	0.9	2.4
	Salvador de Bahia	10,447	10.6	25.6	1.2	0.6
	Sao Paulo	9,477	18.2	15.5	1.5	0.7
Chile	Santiago de Chile	8,825	27.2	16.8	0.7	2.0
Colombia	Barranquilla	15,852	7.5	19.9	0.9	0.0
	Bogota	19,333	9.8	14.9	1.3	4.5
	Cali	18,397	8.4	19.9	1.6	1.1
	Medellin	19,596	5.3	34.3	0.7	3.2
	Monteria	8,485	16.5	5.5	0.0	2.7
	Pereira	10,405	16.1	21.8	3.0	0.2
Costa Rica	San Jose	5,358	37.6	8.4	0.0	0.1
Ecuador	Quito	4,348	18.6	14.4	1.7	4.1
Mexico	Mexico City	7,818	16.0	9.5	1.3	0.3
	Guadalajara	6,520	23.1	17.5	0.2	0.7
	Leon	5,966	17.8	21.5	0.6	3.8
Panama	Panama City	6,172	11.6	8.8	0.2	0.4
Peru	Lima	12,211	13.9	9.9	0.3	1.2
Uruguay	Montevideo	3,122	37.9	9.4	0.9	0.5
Venezuela	Caracas	13,855	7.5	20.3	0.2	1.0
	Maximum	19,596	39.6	34.3	3.0	8.8
	Minimum	2,331	5.3	3.2	0.0	0.0
	Average	9,314	19.5	15.7	0.7	1.6

Source: Authors' elaboration using data from UMO (CAF, 2017).

Not only is it urgent to increase the scale of mobility infrastructure, but also to address the safety problems associated with it.

In addition to vehicle routes, sidewalks are also vital for mobility and access. However, according to the indicators collected in 2014 for the Inter-American Development Bank's Emerging and Sustainable Cities Program (which provides information on environmental sustainability, sustainable urban development, tax sustainability and governance), Latin America has, on average, 2 km of sidewalks per 100,000 inhabitants, a much lower figure than cities in developed countries. For example, in 2017 the New York City Department of Transportation reported around 240 km of sidewalk per 100,000 inhabitants.

The lack of sidewalks and public transport lanes in Latin America is concerning for at least two reasons: i) because most of the region's urban population travels on foot and by public transport, and ii) since the individuals who use these means of transport come mostly from lower-income households, infrastructure deficiencies for these forms of mobility are regressive. In addition to the issue of infrastructure scarcity, there is also the problem of poor infrastructure quality. As documented in this chapter, road traffic accident rates in the region are high compared to developed countries, even when taking their economic development level into account. In this sense, not only is there an urgent need to increase the scale of infrastructure, but also to address convenience and safety issues associated with it, even if a design that prioritizes these aspects has negative effects on the circulation speed of motorized transport.

Exclusive bus lanes, such as those used by bus rapid transit (BRT) systems, are an important factor in urban mobility. The main advantage of this type of lanes is that they enable transit speed to be increased, thus reducing public transport costs in terms of travel time. Predictably, this reallocation of space may affect private transport, although its benefits are not clear. On one hand, it reduces traffic congestion produced by bus stops on routes shared with cars, but on the other hand, space is lost to exclusive public transport lanes. Whatever the net impact on private transport, the aggregate social effect on efficiency and equity may be positive, as mass transit on exclusive lanes is able to transport a larger number of passengers over a given distance, and is used by relatively lower-income individuals. Furthermore, unlike public transport subsidies, dedicated lanes enable the cost of public transport to be reduced without committing tax resources to service operation expenses (Basso and Silva, 2014).

Finally, two of the arguments outlined in the analytical framework should be emphasized. First, road infrastructure investment is frequently promoted as a measure to reduce traffic congestion. However, this objective may be impossible to achieve, as the construction of road infrastructure reduces the cost of car use, which in turn increases demand.[36] This does not imply that infrastructure investments are sterile, as they may improve accessibility

36. Duranton and Turner (2011) show that in the United States, the number of vehicle-kilometers traveled (VKT) increases proportionally to the extent of urban freeways.

which, as has been analyzed, is a desirable objective because it implies improvements in wellbeing. However, a rigorous estimation of all costs and benefits associated with the construction of new road infrastructure is required to understand its impact on society. Second, it is important to remember that mobility infrastructure not only connects different points within a city, but also influences the city's layout and determines its size. For example, the construction of an urban freeway that reduces the cost of traveling from the outskirts to the center makes living in the suburbs more attractive, where land prices are lower (Baum-Snow, 2007). Therefore, as outlined in Chapter 2, decisions regarding urban mobility are not separate from decisions regarding the size and layout of a city.

Private provision of public transport is common, and includes both formal and regulated services, as well as a wide range of informal services.

The public transport system

The public transport system must be addressed as a complex system, comprised of infrastructure (see previous subsection), fleets, procedures and fares, in which several public and private-sector bodies intervene. Indeed, private provision of public transport is common, and includes both formal and regulated services, as well as a wide range of informal services.

No single mode or type of public transport outweighs the others in all aspects. While road systems are less costly, both in terms of infrastructure and operation, rail systems are faster and usually have a greater capacity (together with BRT systems).[37] The flexibility of routes and origin-destination connectivity are facilitated in lower-capacity systems, such as informal transportation. However, as with private cars, lower-capacity systems tend to use a much greater proportion of public space per passenger than mass transit systems. In terms of the previously-outlined externalities (congestion, pollution, and road safety issues), informal systems (and private vehicles) are the most problematic. Among mass transit options, rail systems tend to be less polluting due to their use of electricity, compared to the use of fossil fuels by road systems. However, recent technological advances have closed the environmental gap between the two systems (Pojani and Stead, 2015).

Despite the marked differences in the operating and infrastructure costs of different forms of public transport, the average minimum fares for these means of transport are fairly similar. According to the UMO, the average minimum fare in the region (measured in US dollars as of 2007) is USD 0.60 for buses, USD 0.70 for metro and train systems, and USD 0.80 for microbuses. For reasons similar to those discussed in the case of private vehicle regulation policies, from a conceptual viewpoint, setting fares based on system congestion could promote efficiency and equity. In London, for example, public transport fares are higher at peak times. Meanwhile, public

37. Informal means are not exempt from costs. For example, inspections and regulation of the informal transport supply may represent significant costs, even if the actual number of inspections is relatively low.

transport fares in the region are not usually related to the time of day, or even the distance traveled.

The public transport system plays a primary role in the way in which cities' inhabitants travel, and the quality of life in these cities. Within this framework, the public transport system (which usually provides subsidized fares) represents a tool for inclusion for two reasons: i) because the ability to move around a city is necessary to access opportunities, and ii) because many citizens are not able to purchase a private vehicle. In addition, public transport may potentially contribute to a reduction in dependence on private vehicles and, as such, a decrease in congestion and pollution externalities.

In that sense, public transport policy must adopt a conservative stance with regard to the potential ability of some policies (for example, fare reductions) to considerably reduce private car use on their own, above all due to system quality levels. This should be conceived as a component of a more comprehensive strategy, complemented by private car use regulation policies and measures to improve mobility infrastructure. On the other hand, the assessment of the region's public transport system clearly indicates the urgent need for improvements in terms of quality and coverage, with the main challenges being the fragmentation and informality that characterize the region's transport system.

Public transport supply and congestion

Can public transport reduce mobility externalities? Intuitively, it could be expected that in the extent to which public transport attracts more passengers, congestion will decrease, and mobility will increase, generating the well-known positive impacts on the environment, safety and accessibility. However, this may not be the case. Users who decide to leave their cars at home in order to travel on public transport may be replaced by new users encouraged by the momentary reduction in congestion. In fact, Duranton and Turner (2011) did not find evidence to support the hypothesis that an increase in the provision of public transport reduces vehicle-kilometers traveled.[38]

Furthermore, other research has indicated that an increase in bus services may even increase congestion due to the fact that the flow of buses tends to reduce the capacity of available routes (Winston and Langer, 2006). For his part, Bull (2003) reports a similar result for Chile. According to the author, although the construction of exclusive public transport lanes reduces travel times for buses that can access these routes, private vehicle users on shared routes experienced an increase in delays. Similarly, some research suggests that urban metro systems in developing countries may

38. In the same research, Duranton and Turner (2011) found that the construction of new routes did not have a significant impact on vehicle traffic, as it encourages an increase in the number of journeys made by users. This finding, which the authors call the 'fundamental law of road congestion', is also valid for the case of increases in public transport use.

not have a significant impact on surface-level mobility, due to the fact that metro users would largely switch to this system from other means of public transport and, to a lesser extent, from private cars (Allport and Thomson, 1990).

Public transport demand elasticity due to fare variations has been estimated to be low, especially at peak times.

Despite the evidence suggesting that, in the best-case scenario, the effects of changes in public transport supply on the reduction of congestion are moderate, there is also evidence that gives rise to a more optimistic outlook. Upon analyzing the Los Angeles (United States) Metropolitan Transportation Authority workers' strike that occurred in October 2003 and paralyzed bus and train services in the city for 35 days, Anderson (2014) estimates that the cessation of public transport generated a 47% increase in highway delays at peak times. Similarly, the study highlights the fact that public transport disproportionately attracts commuters from the most congested routes. Also in Los Angeles, Boarnet et al. (2013) found that the new light rail system reduced vehicle transit and, therefore, alleviated congestion.

In addition to the expansion of system capacity, fares constitute another potential tool to promote public transport use. However, the effectiveness of this measure is not fully clear either, as public transport demand elasticity due to fare variations has been estimated to be low. For example, Goodwin (1992) reviewed 50 studies on the topic and concluded that a 10% reduction in bus or metro fares generated a demand increase of just 4%, while a reduction of the same magnitude in train fares produced an increase of almost 8% in demand.[39] This low price elasticity of demand suggests that reducing fares alone is not the most effective way to encourage public transport use.[40] Furthermore, evidence indicates that demand elasticity due to fare variations is even lower at peak times, precisely when congestion is greater and therefore policies must be at their most effective (Pham and Linsalata, 1991). Demand elasticity due to fare variations appears to be greater for short journeys (when walking is an alternative), and for journeys other than commuting (which are therefore more dispensable). In this sense, fare reductions not only are not very effective in promoting an increase in public transport use, but may also harm service quality and, in consequence, discourage the use of public transport.[41]

39. More recent studies have found similar short-term elasticity, confirming the low-price elasticity of demand for public transport (McCollom and Pratt, 2004).

40. In line with these results, other studies have also found low cross elasticity. That is, public transport fare reductions do not discourage private car use (Litman, 2004).

41. Several studies estimate elasticity with regard to quality parameters. One such study found elasticity based on the number of vehicles per kilometer (a proxy for service frequency) of between 0.4 in the short term and 0.7 in the long term (Balcombe et al., 2004). Others report bus service demand elasticity based on overall cost (including not only fares, but also travel time, waiting time and walking time) of between -0,4 and -1,7.

Almost 90% of public transport seats in the region are provided by road transport.

As indicated previously, the overall evidence implies a conservative position on the effectiveness of public transport policies in promoting significant migration from private car use and, in this way, reducing congestion and other externalities. However, there are other reasons why improving public transport quality and increasing the quantity of services is desirable,[42] in particular, as has been mentioned, due to the high percentage of the population that uses this means of transport in Latin America. For these users, improvements in system coverage and quality increase their wellbeing. On the other hand, the lack of a good public transport system hinders the effectiveness of other strategies in reducing private transport use. According to a study by the United States Congressional Budget Office (CBO), an increase in fuel prices is able to reduce traffic solely on highways where there is a parallel public transport service (CBO, 2008).

Fragmentation and informality

As has been mentioned previously, almost 90% of public transportation seats in the region are provided by road transport. This supply is highly fragmented, particularly when considering the non-mass transit supply, such as four-by-fours, combis and microbuses, which account for a third of all road vehicle seats. This fragmentation is evident in cities such as Caracas, for example, where the collective transport service is characterized by the expansion of microbus and four-by-four operations. Between 1988 and 2007, the number of organizations offering share transport services increased from 71 to 169, and the number of routes increased from 220 to 402. In the case of four-by-fours, as of 2007, there were more than 80 organizations in existence (CAF, 2011).[43] This fragmentation is detrimental to service efficiency, in that it hinders the transfer of passengers between transport modes (and even between routes). Indeed, integration and coordination between systems can increase users' wellbeing. Fragmentation, particularly when arising from the informal supply, complicates this task.

Additionally, the costs of small-scale, fragmented and informal systems go beyond the lack of integration. In principle, an ownership structure exists—characterized by single-vehicle companies or individuals operating their own vehicle—which encourages drivers to implement practices that affect service quality, such as operating only in specific locations and during peak times (because they are more profitable), leaving users at non-peak times and on quieter routes unattended. Within this framework, users are obligated to face erratic schedules and prolonged waiting times at certain times of day. In addition, competition for users on routes (also known as "the penny war") leads to aggressive and dangerous driving which is detrimental to road safety. Another strategy to maximize the number of passengers is to allow users to request specific boarding and drop-off points, which contributes to congestion and prolongs travel times.

42. Canavire et al. (2016) suggest that crime reduction is an additional benefit of public transport network expansion.

43. Fragmentation is also observed in the bus systems of other cities. For example, in Buenos Aires, the bus network is operated by 231 private firms that serve 313 routes. In Río de Janeiro, there are around 170 firms, and San José there are 39 (CAF, 2011).

On the other hand, a fragmented system is difficult for the State to monitor and regulate, which facilitates operations with low safety standards and insufficient vehicle maintenance, thus increasing safety, pollution and congestion issues. The lack of inspections also implies tax evasion, as well as failure to comply with regulated fares and, what's worse, an absence of liability in the case of harm caused to users.

However, the informal system also offers certain advantages that should be acknowledged: i) it represents a source of employment for vulnerable families, ii) the service is often more closely aligned to users' needs (offering more flexible routes and providing a demand-based service), and iii) its geographic coverage complements that of formal transport supply. Indeed, in some areas, particularly in slums, this is the only mobility option available (other than traveling on foot), or the only option that provides access to formal transport stations.

The 2016 CAF Survey evaluated the extent to which informal transport operates as a complement to formal transport supply. Based on this survey, Table 3.2 displays the percentage of households that can access formal transport in less than 10 minutes, as well as the percentage that can access any means of transport (formal or informal) in that time. These statistics are reported for the formal settlement subsample, as well as for the subsample of households located in slums. The information is limited to four cities in the region for which data is available for both subsamples.

Table 3.2 Percentage of the population with access to formal transport or any form of transport less than 10 minutes away for several Latin American cities [a/ b/]

City	Formal settlements		Slums	
	Formal transport	Total transport	Formal transport	Total transport
Buenos Aires	96.8	97.9	88.4	88.8
Fortaleza	96.9	97.9	92.9	94.6
Bogota	66.6	86.0	53.8	70.6
Caracas	74.6	83.2	74.8	86.9
Average	**83.7**	**91.2**	**77.5**	**85.2**

a/ The table is based on the question: "For how long must you walk from you home to access the following means of transport?". The possible transport alternatives are: a) bus/share taxi/BRT; b) taxi/share taxi/ minibus/small truck or SUV/combi (informal); c) metro/subway; d) train; e) taxi; f) motorcycle taxi/bicycle taxi; g) public bicycle. Options a), c) and d) make up the formal transport supply. Bicycles are excluded from the analysis.
b/ All samples exclude private car users.

Source: Authors' elaboration using data from the 2016 CAF Survey (CAF, 2016).

On average, 16% of households located in formal settlements do not have access to formal transport less than 10 minutes away from their home. For slum residents, that figure increases to 23%. Upon considering informal modes of transport, access increases by around 8 percentage points, both for formal settlements and

Even when considering informal transport, a sizable population sector has very low access to public transport, above all in slums.

for slums. The cases of Bogotá, where access to transport increases by almost 18 percentage points when considering informal means, both for formal settlements and slums, and Caracas, where the increase in transport access when considering informal means reaches 8 percentage points in formal settlements and up to 12 percentage points in slums, stand out. These figures indicate that informal transport does indeed complement formal transport, particularly in some cities and for families that live in disadvantaged neighborhoods.[44]

However, even when considering informal transport, a sizable population sector still has very low access to public transport means, especially in slums, which indicates shortcomings in system coverage. This may occur, among other reasons, due to the lack of appropriate road infrastructure, an issue which affects both formal and informal transport supply.

Due to the previously-described problems with informal transportation, and its role as a complement to formal transportation, the informal public transport supply is a clear target for government intervention. These interventions must acknowledge that informality does not imply a lack of organization. In fact, a common type of organization for this transport supply is the formation of "route associations", which emerge spontaneously and provide the minimum order required to operate the route. These organizations constitute entities on which some public policies may be focused. Text box 3.6 outlines some government intervention alternatives to address informal public transport supply.

Text box 3.6 Public policies to address transport informality[a]

1. Organizational interventions. Given their presence on routes that are not covered by formal services, the emphasis on operating at peak times, and the possible lack of compliance with official fares, informal transport may extract monopolistic profits from users. For that reason, promoting competition between informal transport organizations may be a useful tool. This can be achieved, for example, in two ways: i) granting licenses to operate on routes served by these organizations, or ii) associating the verification of certain competitive practices with access to public benefits. On the other hand, due to the sector's illegal nature, operators must pay high commissions/extortion to operate. Therefore, any public policy that reduces corruption should improve the efficiency of the informal sector.

44. Not all cities included in the 2016 CAF Survey are represented in the surveys of slums. In general, these results are verified upon incorporating the 11 cities included in the 2016 CAF Survey. In this case, an average of 21.8% of households surveyed do not have access to formal transport less than 10 minutes away. By incorporating all types of transport, that figure is reduced by 12.9 percentage points. The importance of informal transport is particularly significant in La Paz where, according to the 2016 CAF Survey, only 31.8% of households in formal settlements have access to the formal public transport supply. Furthermore, that figure falls to 16.7% for the lowest-income quartile. Meanwhile, upon including the informal transport supply, access to transport in La Paz increases by 50.9 percentage points, and 61.8 percentage points for the lowest-income quartile in the city.

2. Regulatory reforms. Service quality can be regulated through the requirement of minimum operating standards, and the removal of operating licenses in the case of failure to comply with such standards. A consensus appears to exist that the areas which most urgently require regulation are passenger safety and the enforcement of civil liability insurance. In contrast, regulation on the maximum number of operators is more debatable (see point 1 on the potential benefits of competition). The regulatory process faces enormous challenges, as its effectiveness depends on monitoring mechanisms and law enforcement capacity, which tend to be costly. As such, empowering users to report violations may be of great help. Providing this possibility requires civic education programs, complaints channels available to users and the demonstration that complaints result in actions taken by the authorities (CAF, 2012).

3. Financial initiatives. Small enterprises (including small transport service providers) tend to face restrictions in access to credit that limit their development. As such, policies that improve credit access may contribute to improving system quality if, for example, resources are used to modernize the fleet. In addition, access to resources facilitates verification by the financial institution of practices that are more productive, efficient or beneficial to passengers. An example of this is Vietnam, where tax exemptions and interest rate reductions were offered to minibus owners who renovated and increased their fleet, and used low-emission engines.

4. Infrastructure improvements. The construction of public transport stops, or exclusive public transport lanes may reduce the undesired effects of aggressive driving and lanes blocked by buses.

5. Traffic regulations. As for private car users or formal transport service providers, informal providers may also be subject to this type of regulation. In cities with a large number of cycle rickshaws or motorcycle taxis, this type of strategy is highly recommendable. This is the case for Phnom Penh (Cambodia), where two and three-wheeled vehicles are required to circulate on the right side of the right-hand lane as a lane-use efficiency strategy.

6. Training. Training in business areas may help informal operators to be more efficient through cost reductions and revenue increases. In addition, training on traffic regulations, safety practices, mechanics or customer care may result in better service by providers. The design of these training programs must establish simple and technical messages that are appropriate for beneficiaries' education level.

a. This text box was prepared based on Cervero (2001).

Meanwhile, due to their nature, transport modes based on mobile applications, such as Uber, whose use is incipient in the region, require a special mention. According to the 2016 CAF Survey, the percentage of people who use Uber or similar systems on a daily basis for their commute to work only barely exceeds 1% on average. However, in cities such as Bogotá and Panama City, that figure increases to almost 4%.

ICT may be used as a tool to facilitate information integration in the public transport systems, with the corresponding impact on quality.

Despite the fact that their current level of use is low, it is highly likely that this type of transport supply will grow in popularity, due to the convenience of the service (possibility of monitoring journeys, option of evaluating drivers, more payment alternatives). However, some disputes have arisen around these systems. Local taxi cooperatives, for example, complain about the business model used by Uber and similar systems, arguing that it amounts to unfair competition because they do not have to pay for licenses. Similarly, in the case of bankruptcy among competitors, the system could exercise monopoly power, and the lack of professionalization of service providers has also been questioned. Future regulation of this type of systems must provide answers to these debates.

It should be emphasized that the role of ICT goes beyond the application-based transport supply. Indeed, it may also be a tool for facilitating information integration in public transport systems, driving journey planning by users and service providers, and promoting route planning by transport authorities, with the corresponding impacts on system quality.

Conclusions

Mobility is inherent to modern economies and life in the city. The way in which cities' inhabitants transport themselves affects development, in that it determines to what extent, and at what cost, it is possible to take advantage of the opportunities offered by a city. However, the relationship between mobility and development is bidirectional. The level of development also determines how we transport ourselves. That is, mobility quality depends on the (economic and institutional) resources available to a society. This does not imply that mobility patterns cannot be altered. On the contrary, it is possible and necessary to improve citizens' quality of life through urban mobility policies.

To achieve this, a consensus on the objective of urban mobility policies must be achieved as a starting point. The challenge is to use these policies as instruments to resolve the efficiency and equity issues associated with mobility. Therefore, the objective of such policies should not be to eliminate congestion or maximize the number of kilometers traveled per person and/or good. The final objective should be to improve accessibility and social wellbeing, minimizing the externalities associated with motorized transport use, promoting adequate infrastructure provision, resolving challenges related to public transport operation and guaranteeing the availability of appropriate mobility options to meet the needs of different population groups, particularly those with lower resources. In achieving this objective, mobility policies complement urban policies in areas such as land use and housing.

One of the main challenges related to mobility in the region is the rapid increase in car and motorcycle use. As documented in this chapter, individual motorized transport produces significant externalities including congestion, road safety issues and environmental pollution. This report advocates an approach that obliges car and motorcycle users to internalize the social costs that their journeys

generate. There are a series of regulatory policies that may be used for this purpose. Some may link the private and social costs of car use directly (through taxes), while others impose more general restrictions on private transport use. The effectiveness of these policies varies considerably depending on their design and implementation. For example, the evidence indicates that despite their good intentions, driving restriction programs (such as the Pico y Placa program in Bogota and Quito) may have contrary effects to those desired in the long term, due to the fact that they encourage an increase in the vehicle fleet.

Furthermore, the little evidence available suggests that mobility infrastructure in the region is insufficient, particularly for alternatives to private car use. The high traffic accident rates present in Latin America (even when controlling for the region's development level) indicate the urgent need to improve pedestrian infrastructure. Meanwhile, exclusive bus lanes are an increasingly prevalent option, but their use remains scarce in the region. The main advantage of this type of route is that, by increasing travel speed, it enables the cost of public transport in terms of time spent by households to be reduced, without committing tax resources to service operation expenses.

Finally, the expansion of coverage and improvement in quality of public transport, the most widely-used means of transport in the region, are urgent goals. However, these two objectives are often mutually exclusive. For example, while setting low public transport fares may increase use (although in practice this increase is limited), this strategy may also be detrimental to system quality. Meanwhile, integration between different means of public transport, and between public transport and other transport modes, constitutes a tool for achieving high service quality. However, the informality of a significant part of the road transport supply represents a clear challenge in achieving integration and quality.

It may be argued that in the context of developing countries, with public safety concerns, macroeconomic imbalances, unemployment, labor informality, inequality and poverty, etc., mobility policies may not be a priority for policymakers. However, sustaining this position implies disregarding the importance of mobility both for economic development and people's wellbeing. In that sense, improving urban mobility should be a key public policy objective.

Appendix

Data on the number of cars was obtained from the World Health Organization, while population data was obtained from the World Bank. All data is for 2013, and the regions are comprised as follows:

Africa: Algeria, Angola, Benin, Botswana, Burkina Faso, Cape Verde, Central African Republic, Chad, the Democratic Republic of the Congo, Ethiopia, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Ivory Coast, Kenya, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Mauritius, Mozambique, Namibia, Niger, Nigeria, Republic of the Congo, Rwanda, Senegal, Seychelles, Sierra Leone, South Africa, Swaziland, Tanzania, Togo, Uganda, Zambia and Zimbabwe.

The Middle East and North Africa: Afghanistan, Bahrain, Egypt, Iran, Iraq, Israel, Jordan, Kuwait, Lebanon, Morocco, Oman, Pakistan, Saudi Arabia, Sudan, Tunisia, United Arab Emirates and Yemen.

Latin America and the Caribbean: Antigua and Barbuda, the Bahamas, Barbados, Bolivia, Brazil, Chile, Colombia, Costa Rica, Cuba, Dominica, the Dominican Republic, Ecuador, El Salvador, Guatemala, Guyana, Honduras, Jamaica, Mexico, Nicaragua, Panama, Paraguay, Peru, Saint Lucia, Saint Vincent and the Grenadines, Suriname and Uruguay.

North America: The United States and Canada.

Europe: Albania, Austria, Belgium, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Macedonia, Malta, Montenegro, the Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

Southeast Asia and Oceania: Australia, Cambodia, China, the Federated States of Micronesia, Fiji, Japan, Kiribati, Laos, Malaysia, Marshall Islands, Mongolia, New Zealand, Palau, Papua New Guinea, the Philippines, Samoa, Singapore, Solomon Islands, South Korea, Tonga, Vanuatu and Vietnam.

HOUSING MARKETS AND URBAN INFORMALITY

Chapter 4

Chapter 4
HOUSING MARKETS AND URBAN INFORMALITY[1]

Introduction

Housing is a fundamental aspect of peoples' wellbeing and their capacity to seamlessly integrate with the city, both in their personal and professional lives. At the same time, most of a city's physical expanse is destined to house residential buildings for its inhabitants.[2] The housing market is therefore a critical part of the city's operation, and when supported by adequate public policies, its success promotes access to housing for everyone.

The characteristics of a city's housing inventory relates closely to several factors identified in this report. As pointed out in Chapter 1, agglomeration forces, congestion costs and the presence of urban amenities shape the distribution of the population in the system of cities and within each city. It follows that these factors bear heavily on determining housing supply and demand. Chapter 2 details how regulations on land use aim to mitigate congestion problems by zoning housing areas and defining, amongst other things, their required characteristics. Finally, Chapter 3 shows how transport networks alter the economic value of the land and encourage households to choose better-connected zones.

However, it is necessary to point out that a city's housing inventory is not a passive consequence of these factors. On the contrary, it has an active impact on the functioning of cities and influences the equilibrium between agglomeration forces, congestion costs and amenities. This chapter analyses the relevance of housing to how cities operate, with an emphasis on the housing situation in Latin America.

Housing markets impact productivity and employment. As a city becomes more productive, its wages rise. As long as wage improvements are not offset by increases in congestion costs, and there is an adequate level of amenities, this dynamic will lure new workers into the city, who in turn demand new housing. At that point, the housing market becomes critical to the city's future: if housing supply expands (for example, through the building of additional units), the city will successfully absorb new residents and increased productivity will result in the expansion of employment generated in the city (and, consequently, population growth). However, if housing construction does not respond to an increase in demand, competition for existing housing will push prices up. In this case, total

1. This chapter was written by Pablo Brassiolo and Gustavo Fajardo, with research assistance from Agustina Hatrick, Matías Italia, Federico Juncosa and Cynthia Marchioni.

2. Consider the Province of Buenos Aires as an example: 64% of the zoned urban area is assigned to diverse types of residential use: 28% for low density residential use; 12% for medium density residential use; 11% for mixed residential use; 10% for private urbanization; and 3% for high density residential use (Goytia et al., 2014).

The proper functioning of the housing market is critical in guaranteeing access by individuals to more productive labor markets.

employment in the city will not grow (since there is no room for additional workers) and increased productivity will result in more expensive housing. This simple conceptual framework implies that the proper functioning of the housing market (defined as its capacity to generate new units in response to increased demand) is critical in guaranteeing access by individuals to more productive labor markets, as they look for higher wages and employment levels. In contrast, a paralyzed housing supply constitutes a bottleneck to the expansion of productivity and the efficient geographical allocation of a country's human resources.

Housing markets also determine the wellbeing of city dwellers. Beyond their importance to aggregate productivity and employment, houses have a strong effect on their inhabitants, which goes beyond the dichotomy of having or lacking access to it. There is a multiplicity of housing attributes capable of transforming individuals' lives for better or for worse. A substandard construction with insufficient space cannot generate the same wellbeing as an amply spaced, solid construction. Likewise, access to basic services such as tap water, electricity and sewage has a sizable impact on the development of individuals. Quality housing, in the broad sense of the word, favors better levels of health, education and individual satisfaction, which in turn translate into higher levels of productivity and wellbeing.

Another attribute of a house that directly impacts its dwellers is its location. This happens through at least two different channels. The first is linked to the characteristics of the physical and social environment. Living in a neighborhood without access to cultural and recreational services and parks, with high levels of poverty and social marginalization, limits individual possibilities of progress. The social networks that are formed under these conditions beget scant integration opportunities in the formal labor market, and negative role models abound. Thus, the economic segregation of residential areas diminishes social mobility. The second channel is related to access to jobs. In addition to amenities that are absent in rural areas, an essential attraction of cities is the availability of better job opportunities provided by agglomeration economies. The possibility of exploiting such opportunities is restricted to those living in marginalized areas with poor accessibility.

Both the individual reasons (better wellbeing and more accessibility) and the aggregated ones (greater productivity and more employment) explain why enabling access to quality housing is generally considered a responsibility of the government (even an explicit mandate in the legislation of some countries). However, the housing supply does not appear to always respond to this mandate and the gap between what is normatively desirable and what is actually observed seems wider in developing countries. For example, there is a common impression when touring many Latin American cities that there is an important deficit in residential infrastructure. Two of the phenomena that characterize the cities of the region are the considerable number of households living in precarious neighborhoods with insufficient infrastructure and substandard housing; and the informal duality of the housing market, where the formal sector coexists with a sector that serves a large percentage of the

population, particularly in the lower socio-economic levels. Both phenomena are closely interrelated.

Slums are the clearest example of precarious housing in Latin America. According to the United Nations' Global Urban Observatory, the number of Latin Americans living in them is close to one in five. The existence of these slums is not exclusive to Latin American cities. They also exist in large cities in developing countries outside Latin America, and were formerly found in the main cities of currently developed countries. This does not, however, diminish the priority that slums should have in the housing policy debate in Latin America. Some of the most relevant questions in this respect relate to the causes of the creation and proliferation of these slums, their consequences on households and individuals, and the policy tools available to address and improve living conditions in those spaces.

This chapter offers a diagnosis of housing markets in the region and discusses the available information on quantity and quality of housing services consumed by Latin Americans, and the price they pay for them. In addition, it delves into an analysis on slums, characterizing (albeit partially) the living conditions to be found there.[3] Likewise, based on existing evidence, the chapter proposes general outlines that could guide housing policy in the region and introduces four ideas that are central to any policymaking discussion on the subject: i) inefficiencies in the housing market and poverty levels simultaneously operate to generate housing deficits; ii) a rigid housing supply limits the efficacy of policies designed to stimulate housing demand, which implies that promoting a more dynamic residential supply should be prioritized; iii) given the dual nature of housing markets, regulations pertaining housing have to consider a likely impact on the incidence of informal solutions; and iv) the final objective should aim at universal access to housing, as opposed to universal ownership.

Finally, the chapter focuses on the debate surrounding policies aimed at slum dwellers, which generally coincide with the low-income sectors of urban economies. These policies imply an active participation by the State and have an important redistributive component. The main question in this discussion is what is the most efficient way to permanently improve the living conditions of these households. It is essential to point out that there is no definitive answer and that the debate remains open. More than discussing the best specific policies to increase the wellbeing of households, it must be emphasized that to reduce the widespread incidence of urban slums, localized policies must be transcended to incorporate structural corrections.

3. To better understand this dynamic and generate a source of data for this report, a survey was carried out in slums located in four cities in the region. Chapter 1 describes this work in detail

Approximately 1 in 3 Latin American households live in substandard housing units, mainly due to lack of access to basic services.

Housing markets in Latin America: A diagnosis

Qualitative deficits

A traditional approach to assessing the performance of the housing sector is to estimate the percentage of households living in "substandard" units. This approach stems from the notion that there are certain minimum quality standards for housing to be considered "decent", and constructions that do not meet these conditions are therefore substandard.

Conducting such an exercise requires, first, defining the set of attributes to be considered when evaluating housing quality. Existing measurements emphasize the importance of the quality of construction materials, the ratio between number of rooms and number of household members, access to basic services (tap water, electricity, sewage) and the security of property rights. Second, one must establish the threshold of sufficiency for each of these attributes: what construction materials are substandard, how many rooms should a dwelling have, what constitutes a secure title, etc. This methodology is used to calculate the qualitative housing deficit within a population as the rate of households living in substandard units.[4]

Approximately 1 in 3 Latin American households live in substandard housing units. Based in household survey data, Table 4.1 shows the corresponding country estimates. Chile and Costa Rica present the lowest rates (17% and 10% respectively). At the other end of the spectrum, almost half of Bolivia, El Salvador and Guatemala's urban dwellings exhibit some form of insufficiency. The main source of deficit in the region is lack of access to basic services, more specifically, the high rate of households that are not connected to a sewer or sewage network. This situation affects over a quarter of the homes in El Salvador and Paraguay. In contrast, the connection to the electric grid in the cities of the region is almost universal. Likewise, the lack of security in housing tenure is significant, a problem that affects more than 20% of households in Peru and Uruguay.[5]

4. These statistics are oftentimes accompanied by an estimate of the quantitative deficit, which is the number (or percentage) of households that cohabit a unit with the main household, or are in temporary shelters that cannot be considered temporary housing and cannot be transformed into permanent housing due to the poor quality of the construction.

5. This number is subject to inaccuracy due to the fact that the information on security of tenure collected through the surveys is self-reported.

Table 4.1 Qualitative deficit in urban zones, for selected Latin American countries circa 2015 [a/]

	Total [b/]	Materials	Housing tenure	Overcrowding	Basic services			
					Total basic services[c/]	Tap water	Sewage	Electricity
Argentina (2015)	19	1	9	3	9	0	9	-
Bolivia (2014)	51	23	18	9	24	7	21	1
Brazil (2014)	21	0	6	0	16	1	16	0
Chile (2015)	17	3	14	0	1	0	1	0
Colombia (2014)	39	30	14	1	6	3	3	0
Costa Rica (2015)	10	2	8	0	2	0	1	0
Ecuador (2014)	40	8	15	1	26	25	3	0
El Salvador (2013)	46	17	16	8	32	15	28	2
Guatemala (2014)	47	20	10	15	28	9	21	5
Honduras (2014)	32	2	8	3	26	6	25	1
Mexico (2014)	41	19	15	0	23	4	22	0
Paraguay (2014)	36	0	8	4	30	4	29	0
Peru (2015)	39	12	22	4	17	10	12	1
Dominican Republic (2014)	31	11	7	1	23	17	14	0
Uruguay (2015)	24	1	21	1	5	0	5	0
Average	**33**	**10**	**13**	**3**	**18**	**7**	**14**	**1**

a/ The table shows the percentage of urban dwellings with qualitative deficit, split into categories.
b/ The Total column shows the percentage of dwellings with at least one substandard category: Materials, Housing tenure, Overcrowding or Total basic services.
c/ The Total basic services column shows the percentage of dwellings with at least one substandard category: Tap water, Sewage or Electricity.

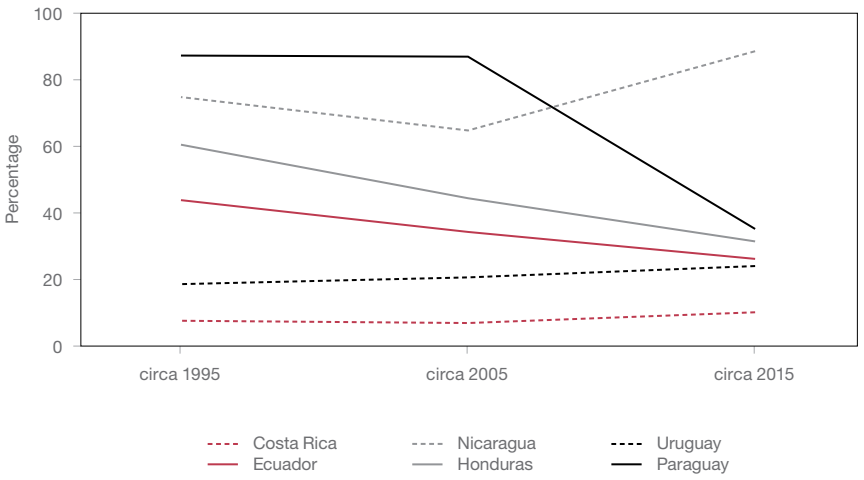
Source: Authors' elaboration using data from CEDLAS (2017).

Housing deficit rates are not uniform within the system of cities of Latin American countries.

The good news is that most countries in the region have reduced their deficit during the past decades. Ecuador, Honduras and Paraguay, for example, show impressive progress, with a significant decrease in their qualitative deficit rate during the past 20 years (see Graph 4.1). Costa Rica, Nicaragua and Uruguay appear to have lost ground, although Costa Rica and Uruguay still remain amongst the countries with the lowest housing deficit in the region. It is worth noting that a substantial part of the gap reduction is a consequence of improvements in increased connectivity to basic services.

Housing deficit rates are not uniform within the system of cities of countries. The data for Colombia, for example, show a negative correlation between the size of the city and the percentage of dwellings with qualitative deficit (see Graph 4.1). Smaller cities have a higher percentage of households living in substandard dwellings. This could be linked to a poorer supply of public services in secondary cities, which in turn might be a driver of migration toward larger ones.

Graph 4.1 Evolution of the qualitative deficit rates in urban zones across three periods, for selected Latin American countries [a/ b/]



a/ The graph shows the percentage of urban households with qualitative deficit. The three top-performing and bottom-performing countries (within the available data) are shown.
b/ The years surveyed for each country are: Costa Rica (1997, 2005, 2015), Ecuador (1995, 2006, 2014), Honduras (1995, 2005, 2014), Nicaragua (1998, 2005, 2014), Paraguay (1997, 2005, 2014), Uruguay (1995, 2005, 2015).

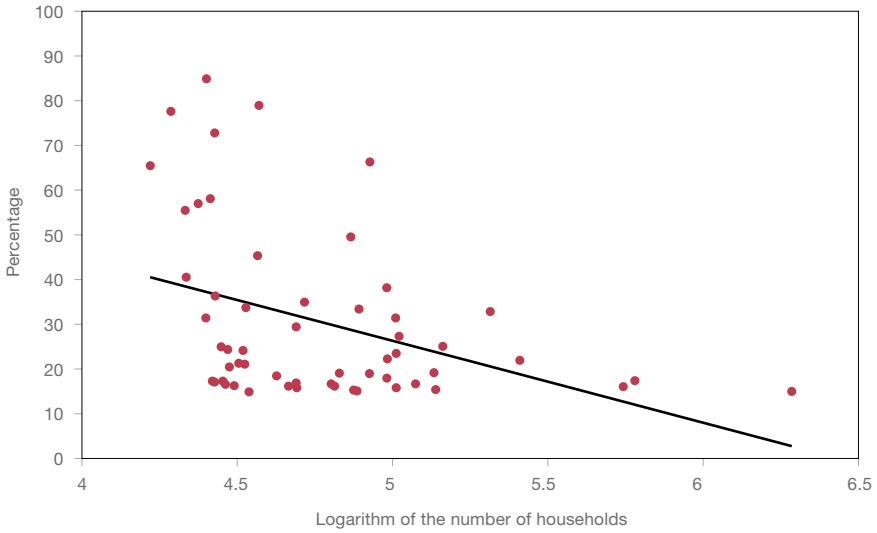
Source: Authors' elaboration using data from CEDLAS (2017).

The main strength of this approach to quantifying housing deficits lies in that the variables used to evaluate housing standards do have an important effect on the wellbeing of dwellers, which in turn highlights the importance

of closely monitoring them. However, this measurement criterion (normative in nature) is not without problems. Several key housing attributes (such as distance to job opportunities and neighborhood characteristics) are often overlooked, and the sufficiency thresholds are somewhat arbitrary. This criterion also implicitly homogenizes the needs of different households. Finally, perhaps the main problem is that the indicators produced under this approach are not particularly helpful in discovering the underlying causes of the deficits.

To obtain a more complete diagnosis, we need to include information on the prices of housing services and the quantities consumed. As in any other market, these two variables characterize the equilibrium reached in a given moment, and can bring to light some clues about the inner workings of the housing market.

Graph 4.2 Relationship between the percentage of households with qualitative deficit and the city size of the city in Colombia for selected municipalities in 2005 [a/]



a/ Each dot in the graph represents a municipality. Cities with over 100,000 inhabitants are included, according to a 2005 survey. The straight line represents the regression by ordinary least squares of the percentage of substandard dwellings vs. the logarithm of the total number of dwellings in the city, which becomes an approximation of the city size.

Source: Authors' elaboration using data on housing deficit from DANE (2005)..

What prices reveal

This section assesses how the housing markets in the region operate using price data. First, the square meter price of housing is compared

with household income, revealing a problem of limited affordability in the region. Then, some evidence suggesting that the observed high prices are partially due to supply restrictions is presented. This signals that such prices do not respond exclusively to demand factors, which opens an ample discussion on supply policiesin the following sections. Finally, indicators of the high variability of prices within cities are shown, as evidence that the value assigned to a housing unit includes elements that go beyond the construction itself, something that needs to be considered when defining policies on this matter.

Bearing this in mind, Table 4.2 reports the median square meter price (in USD, as of January 2017) of housing units for different cities in the region with available information.[6] There is significant heterogeneity, with the built square meter being two and a half times more expensive in Santiago de Chile than in Quito.

Table 4.2 Median square meter price by housing type, for selected Latin American cities [a/]

City	Apartment	House
Buenos Aires	2,467	1,719
Santiago de Chile	2,883	2,338
Bogota	1,701	1,204
Quito	1,164	838
Mexico City	1,991	1,579
Lima	1,270	1,434
Montevideo	2,600	1,604

a/ The table shows the median value of the built square meter price distribution by housing type (apartment and house) and city. Prices are shown in USD of January 2017.

Source: Authors' elaboration using data from housing adds from the webpage Mercadolibre.com, extracted in January 2017, and exchange rate data from Bloomberg of January 31, 2017.

A highly relevant issue in public discussion is the affordability of housing. As mentioned in the introduction, the productivity of a city positively correlates with the price of housing, but also with average income. In fact, higher income expectations are usually considered the main pull factor of cities, as migrants expect such a higher income will offset the higher costs of living

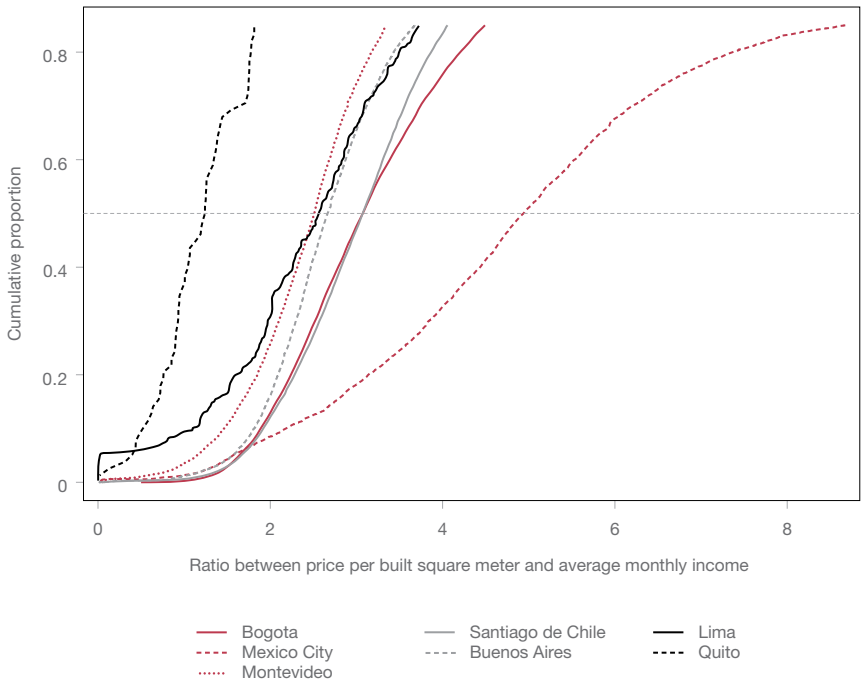
6. Within each city, units for sale are ranked according to the asking price per built square meter. The median unit is the one in the midpoint in this ranking.

in a big city. In this context, the affordability of housing services in a city will depend on its ability to exploit agglomeration economies efficiently and simultaneously guarantee an adequate housing supply.

Most cities require between 2 to 3 months of income to afford one square meter.

Graph 4.3 provides a measure of housing affordability in several Latin American cities by comparing housing unit prices with household income. More specifically, it shows the cumulative distribution of listed housing units according to the number of average monthly incomes required to pay for a square meter (the horizontal line indicates the median unit). According to the graph, Mexico City comes out as the least affordable, requiring 5 months of average income to afford a median value square meter. The rest of the cities require 2 to 3 months of income, while Quito only requires one month.

Graph 4.3 Distribution of units on sale according to the number of months of average labor income required to pay for one square meter for several Latin-American cities [a/]



a/ The graph illustrates the cumulative distribution function of the ratio between price per built square meter of apartments and average monthly income in the city. Housing prices are deflated according to the year when income was surveyed: Bogota (2014), Buenos Aires (2015), Lima (2015), Mexico City (2014), Montevideo (2015), Quito (2014), Santiago de Chile (2015). For further details, see Appendix.

Source: Authors' elaboration using data from housing adds from the webpage Mercadolibre.com, extracted in January 2017; income data from the SEDLAC (CEDLAS and World Bank) household survey database; and inflation data in the housing sector from national statistical offices.

The cities showing the largest gap between prices and costs are those with the greatest restrictions on real estate development.

The magnitude of the affordability issue in the housing markets of the region is better dimensioned in these numbers: certain cities (such as Mexico City) require, on average, roughly 25 years of income to pay for a 60 m^2 housing unit of median value, if the entire income was destined to this purpose. Should a hypothetical household destine 30% of its income to consuming housing services, the number becomes even more staggering: over 30 years of savings would be required to afford a 60 m^2 housing unit of median value in almost every country. However, the comparison between prices and income does not explain the root cause of the problem, since there is no way of telling whether the observed gap can be attributed to the low income of the or to the high prices of the housing units.

Ideally one would like to measure the magnitude of the price deviations caused by inefficiencies in the housing supply, which increase the production cost structure for residential units. To do this, one should contrast observed prices with those that would occur in a hypothetical scenario exempt from housing supply inefficiencies. This hypothetical scenario is, unfortunately, very difficult to estimate. It is, however, possible to look for indications that suggest the presence of supply factors that alter prices in the housing market.

Glaeser and Gyourko (2003) compare the differences between housing prices and construction costs (excluding the cost of land) across US cities. The hypothesis indicates that variations across markets (cities) in the observed deviations between price and construction costs reflect variations in market rigidities that hinder the expansion of the housing supply (see Text box 4.1). The authors found that in 17 of the 40 cities studied, over half of the housing units are more expensive than they should be according to their construction costs.[7] But beyond the specific figure (of little relevance for a discussion on Latin America), the main insight offered is that the cities with more significant differences between price and cost are those with more stringent construction restrictions. This finding is important because oftentimes the existing restrictions are due to regulatory and bureaucratic aspects, and lifting them could facilitate the expansion of the housing supply, thus reducing the price of houses and improving access to them.[8]

7. The criterion used by the authors to consider a housing unit as “expensive” is when its price is equal to or greater than 140% of its construction cost.

8. The exercise proposed by Glaeser & Gyourko (2003) reveals a bottleneck that is characteristic of housing supply: the shortage of building land, which increases its price and increments the difference between construction costs and final prices. However, this analysis overlooks other sources of inefficiencies, such as additional input markets (construction material, labor, etc.), which drive up construction costs.

Text box 4.1 The theoretical relationship between house and land prices in the system of cities

One would expect variations between the construction price of a house and its price. According to the canonic model of a monocentric city (discussed in detail in Chapter 2), the land is more expensive the closer it is to the city center, given employment is concentrated there. Therefore, the price of houses (and the gap between that price and construction costs, which are assumed to be homogeneous within a city) will be higher close to the central business district. As one moves away, land value for urban use decreases. Thus, the physical sprawl of a city eventually reaches a point where the value of land is the same for urban or rural use.

An implication of this model is that the value of land in the urban periphery is equal in all the cities of a system. Consequently, there should not be high variation across cities in the ratio of house prices to construction costs in peripheral areas. Differences in this metric would therefore suggest the existence of restrictions that introduce inefficiencies to the urbanization of plots.

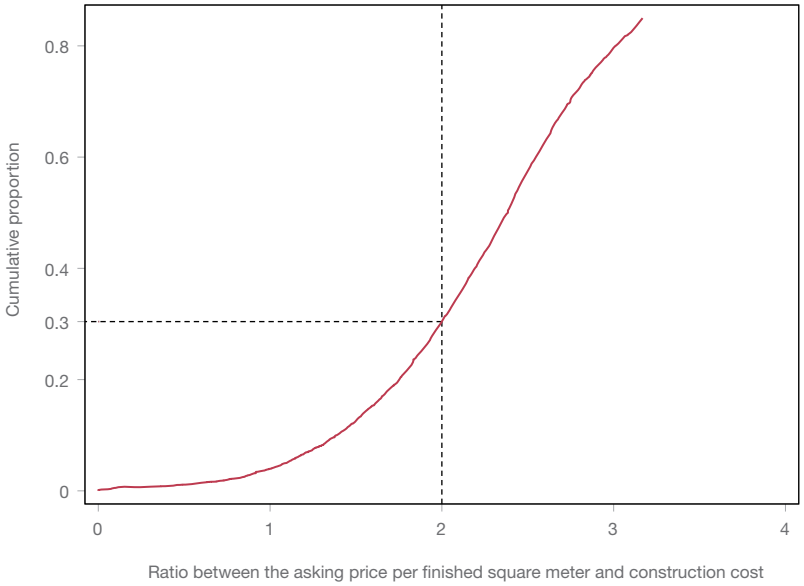
Since the methodology in Glaeser and Gyourko (2003) does not consider only the price of peripher houses, but rather the price of houses across the entire city, it is only an imperfect approximation and must be interpreted with caution.

It is difficult to adapt the methodology of Glaeser and Gyourko to Latin America, since information on construction costs in the region is scarce and unsystematic. Montevideo poses an exception, with published construction costs per square meter by type of construction. Based on data for the category "Medium range apartment buildings with an elevator", Graph 4.4 (see p. 184) shows a comparison between the market price for apartments and their construction cost per square meter. It specifically shows the cumulative distribution function for the ratio between the observed price and construction costs.[9] This exercise reveals that the asking price per square meter exceeds construction costs in most units. As a matter of fact, approximately 70% of the units have an asking price that more than doubles the cost. According to the Glaeser and Gyourko (2003) criterion, the difference observed in Montevideo between price and costs could reflect important distortions that generate bottlenecks in the housing supply.

9. Construction costs are a city average. Thus, they do not vary between units.

The sensitivity of prices to changes in housing demand depends on the ability to increase housing production.

Graph 4.4 Distribution of units on sale in Montevideo according to the ratio between asking price and construction cost per square meter [a/]



a/ The graph illustrates the cumulative distribution function of the ratio between price per built square meter of apartments and their construction cost per square meter. Apartment prices are deflated to their January 2016 value, at which point the construction costs were observed. For those units listed in USD, the value was converted to Uruguayan pesos at the current exchange rate and then deflated.

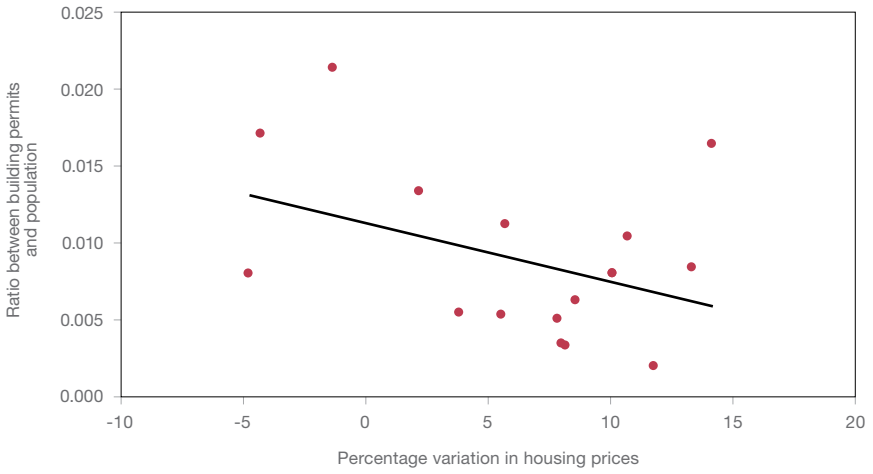
Source: Authors' elaboration using data from housing adds from the webpage Mercadolibre.com, extracted in January 2017; data on construction costs per square meter in Montevideo for the category "Medium range apartment building with elevator" supplied by the National Institute of Statistics, Uruguay; price index variations in the housing category supplied by the National Institute of Statistics, Uruguay; and exchange rate data from Bloomberg of January 31, 2017.

Changes in house prices can also be informative about the functioning of the housing market. However, price dynamics must be interpreted with caution. One can expect that as agglomeration economies increase the productivity of a city, the demand to live in it increases, driving up the value of real estate. However, the sensitivity of prices to changes in housing demand depends on the ability to increase housing production. If the capacity to build houses wereconstant across cities, there would be a positive correlation between changes in housing prices and changes in population: prices would grow more in places with the highest-growing demand. Conversely, if cities with lower demographic growth experience larger increases in housing prices, this would suggest that obstacles to residential construction play a major role on price dynamics.

Using data for Colombian cities, Graph 4.5 shows the correlation between the number of building permits for housing units issued in 2015, normalized by the population in 2005 (a measure of the pace of housing construction) and the change in housing prices between the fourth quarter of 2014 and the fourth

quarter of 2015.[10] The negative correlation suggests that demand is not the sole responsible for price variations. Thus, supply factors seem to play a significant role in housing markets.

Graph 4.5 Relationship between the rate of residential construction and the growth of housing prices at municipal level in Colombia in 2015 [a/ b/]



a/ The graph shows a regression by ordinary least squares where the dependent variable is the number of building permits issued during 2015, normalized for the 2015 population, and the independent variable is the variation in housing prices between the fourth quarter of 2014 and the fourth quarter of 2015.
b/ Each dot represents a municipality. The municipalities included are: Armenia, Barranquilla, Bogota, Bucaramanga, Cali, Cartagena, Cucuta, Ibageé, Manizales, Medellin, Neiva, Pasto, Pereira, Popayan and Villavicencio. .

Source: Authors' elaboration using data on housing price variation from the Colombian New Housing Price Index (DANE, 2016); data on building permits and population of Colombia (DANE, 2016).

Prices play a fundamental role that cannot be ignored when designing housing policies: they signal the value society assigns to goods and services, and to housing in this particular case. This is relevant for comparisons both across and within cities, where land (and housing) costs vary considerably between neighborhoods according to the value households assign to each zone. These are not arbitrary differences, but rather the result of environmental characteristics that make certain areas more desirable for living than others. Amongst the many variables affecting household preferences are accessibility to jobs, proximity to public services such as schools and health facilities, proximity to parks and recreational areas, and crime levels.

10. The population is circa 2005, this being the most recent year for which population estimates (rather than projections) are available.

The ratio between the most expensive and the cheapest area is greater than 3 in almost all of the cities surveyed.

Table 4.3 compares the median price for the cheapest and the most expensive areas for a selection of cities. The observed gaps could be underestimated for several reasons: i) the information does not cover the entire metropolitan areas of these cities; ii) some areas do not have enough units on sale, therefore the available information is not representative; iii) these areas have a relatively high level of aggregation, which covers the existing heterogeneities within them. Even so, marked contrasts come to light. The ratio between the most expensive and the cheapest area is over 3 to 1 for almost every city, with the largest differences in Buenos Aires, Mexico City and Montevideo, where the square meter in the most expensive neighborhoods sells at 6 times its counterpart in the cheapest areas.

Table 4.3 Ratio between the square meter price for apartments in the most expensive area and the cheapest one, for several Latin American cities [a/]

City	Area	Square meter price	Ratio
Buenos Aires	Puerto Madero	5,784	6.1
	Villa Soldati	950	
Santiago de Chile	Colina	3,538	4.8
	La Pintana	736	
Bogota	Chapinero	2,406	3.2
	Bosa	753	
Mexico City	Miguel Hidalgo	3,509	6.2
	Tláhuac	568	
Lima	Miraflores	2,098	2.8
	San Martín de Porres	761	
Montevideo	Carrasco	3,786	5.9
	Punta de Rieles	645	

a/ The table reports the median value of the square meter price of apartments in each area. The "cheapest" and the "most expensive" ones are defined as those with the lowest/highest median square meter price amongst the apartments listed in each respective city. The ratios could be an underestimation, since the areas geographically outlined belong to administrative jurisdictions, therefore do not necessarily cover the city's total metropolitan area.

Source: Authors' elaboration using data from housing adds from the webpage Mercadolibre.com, extracted in January 2017, and exchange rate data from Bloomberg of January 31, 2017.

Housing consumption

Another relevant variable is the built-up area consumed by each individual. Estimates of this magnitude are scarce, since household surveys and similar instruments do not usually collect this information. To surmount this

limitation, the 2016 CAF Survey included a question on the size, in square meters, of the dwellings occupied by households in Latin America. While misreporting is a concern to keep in mind, these data constitute a useful approximation. For most cities, the number of square meters of housing consumed per person ranges between 23 and 30. The highest values are for Panama City (41 m^2) and Mexico City (32 m^2), while at the other end we find the Brazilian city of Fortaleza (17 m^2).

For most cities, the number of square meters of housing consumed per person ranges between 23 and 30.

Table 4.4 Average square meters per capita in formal urban housing for 11 Latin American cities [a/]

City	Square meters
Fortaleza	17
Buenos Aires	24
Sao Paulo	24
La Paz	25
Bogota	26
Montevideo	26
Quito	26
Caracas	27
Lima	27
Mexico City	32
Panama City	41

a/ The table reports information based on the following questions: i) "What is the size in square meters of the housing unit where your family lives? (or the part of the housing unit for your exclusive use, in the case of shared housing units)?" and ii) "How many people make up your household (including yourself), excluding domestic personnel, if any?"

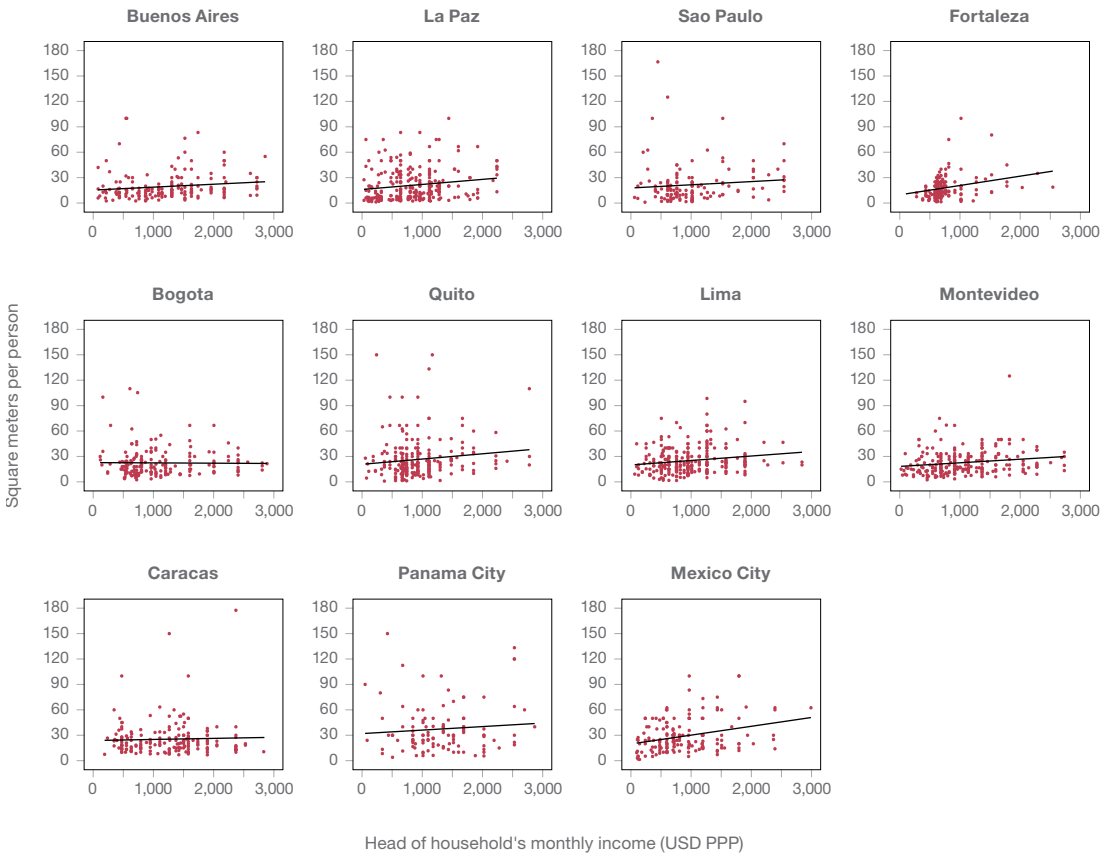
Source: Authors' elaboration using data from the 2016 CAF Survey (CAF, 2016).

One of the fundamental characteristics of housing is that it is a "normal good", meaning that an increase in income is accompanied by an increase in the amount of housing consumed.[11] Perhaps this fact is the main driver of the secular decrease in urban density reported in Chapters 1 and 2 for several regions around the world. It therefore constitutes a reason why economic development is expected to go hand in hand with greater urban sprawl and less densely populated cities.

11. An increase in demand can occur through more spacious or better-quality housing: when a household increases its purchasing power, it moves to a more luxurious or better-located home.

This relation between the amount of housing consumed and income is found in the cross-sectional data from the 2016 CAF Survey. Graph 4.6 illustrates this relationship at the household level by city, and shows that in every case the correlation is positive. As a regional average, a 10% increase in the income of the household head is associated with a 2% increase in per capita square meters of the dwelling. But there are important differences between cities. Mexico City, Fortaleza and Quito show the strongest relation between these variables: a 10% increase in income translates into a 3% to 4% increase in space consumption per person. In contrast, Bogota and Caracas show no correlation (consumption of space in square meters does not increase with income).

Graph 4.6 Relationship between the head of household's monthly income and the housing footage per person, for 11 Latin American cities [a/]



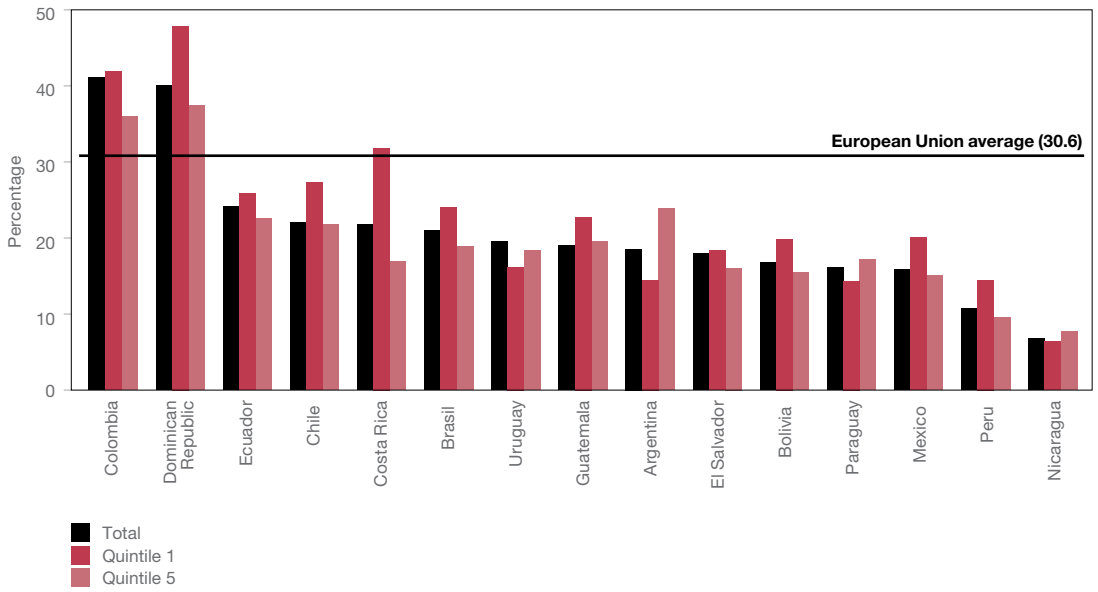
a/ For each graph, the vertical axis measures the amount of square meters per person, and the horizontal axis represents the head of household's income in USD PPP of December 2016. Each red dot represents a household. Only households with data regarding the head of household's income and who live in the formal city are included. The black line represents the linear regression between both variables.

Source: Authors' elaboration using data from the 2016 CAF Survey (CAF, 2016).

The functioning of rental markets

The percentage of households that rent the dwelling in which they live is characteristically low in Latin America. Out of the 15 countries considered in Graph 4.7, only Colombia and Dominican Republic show rates above the European average. In most cases, the number of households that rent the unit they inhabit is below 20%, with the lowest rates found in Mexico (16%), Peru (11%) and Nicaragua (7%). The proportion of households that rent is quite stable across income groups in most countries. Costa Rica and Dominican Republic show a rent bias toward lower income groups, while Argentina has the largest bias in the opposite direction: renting is more common among high-income households.

Graph 4.7 Percentage of households living in rented housing in urban areas of Latin America [a/ b/]



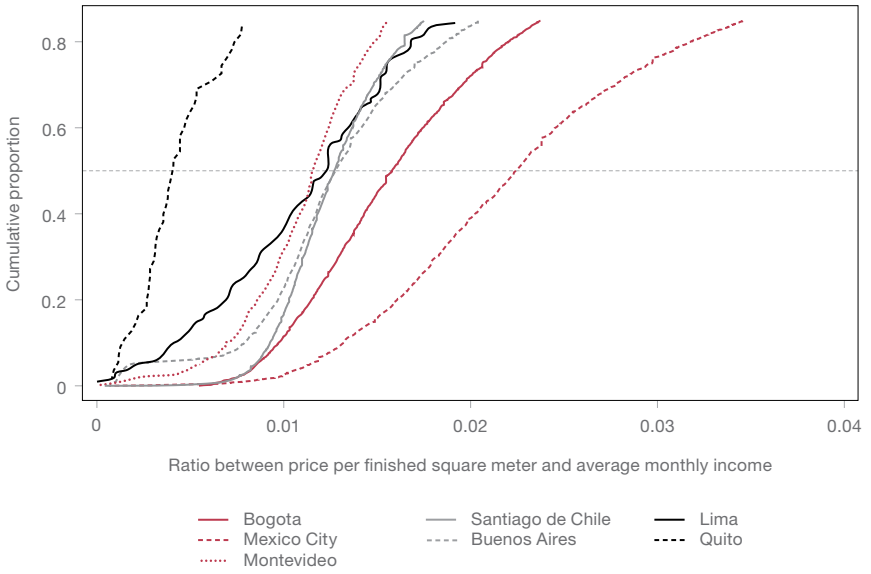
a/ The graph shows the percentage of households living in rented housing for the entire population and for quintiles 1 (poorest) and 5 (richest) of income distribution for each country.
b/ The year surveyed for each country are: Argentina (2015), Bolivia (2014), Brazil (2014), Chile (2015), Colombia (2014), Costa Rica (2015), Ecuador (2014), El Salvador (2013), Guatemala (2014), Mexico (2014), Nicaragua (2014), Paraguay (2014), Peru (2015), Dominican Republic (2014) and Uruguay (2015). The average for European Union member states corresponds to the year 2015.

Source: Authors' elaboration using data from CEDLAS (2017) and Eurostat (2017).

Graph 4.8 (see p. 190) presents statistics on the affordability of the rental market in the region. The graph shows the distribution of units for rent according to the number of months of average labor income required to pay for one square meter. Mexico City stands out as the most expensive amongst the seven cities included in this analysis. The horizontal line indicates that the median square meter for rent in this city costs just over 2% of the monthly income. For Buenos Aires, Santiago de Chile, Lima and Montevideo, this

number is slightly above 1%. The cheapest city according to this exercise is Quito. The inverse of this ratio indicates the number of square meters that can be rented with the total monthly income in each city. However, according to a widely held concept, families should not spend more than 30% of their monthly income on housing services.[12] While this is an arbitrary rule, it clearly exposes the magnitude of the affordability problem in the region. 30% of the average income in Mexico City represents about 14 m^2 of rental housing (according to the median rent per square meter). This number rises to 19 m^2 in Bogota, while it goes up to 24 m^2 in Santiago and Buenos Aires, 25 m^2 in Lima and 26 m^2 in Montevideo.

Graph 4.8 Distribution of units for rent according to the number of months of average labor income required to pay for one square meter for several Latin American cities [a/]



a/ The graph exhibits the cumulative distribution function of the ratio between the rent per built square meter and average monthly income in the city. Rent is deflated according to the year when income was surveyed: Bogotá (2014), Buenos Aires (2015), Lima (2015), Mexico City (2014), Montevideo (2015), Quito (2014), Santiago de Chile (2015). For further details, see Appendix.

Source: Authors' elaboration using data from housing adds from the webpage Mercadolibre.com, extracted in January 2017; income data from the SEDLAC (CEDLAS and World Bank) household survey database; and inflation data in the housing sector from national statistical offices.

12. This criterion stems from a milestone in US law: the Brooke Amendment (named after Senator Edward Brooke), introduced in 1979, which limited the price of public rent to a maximum of 25% of household income. This cap was increased to 30% in 1981. A summary of public housing programs in the United States can be found in Stoloff (2004)

Housing deficits to the extreme: The case of slums

The incidence and size of slums are due to an unfortunate combination of low income and institutional and market failures.

Deficiencies in the housing inventory of Latin American cities are not uniform across different income groups. Lower-income households live in lower-quality housing, located in the most impoverished neighborhoods. According to figures reported by the IDB (2012), the percentage of urban households that experience a qualitative housing deficit (according to the definition offered in this chapter) in Latin America and the Caribbean goes from 12% in the upper quintile of the income distribution to 43% in the bottom quintile.

Slums may constitute the most extreme manifestation of the housing scarceness in the region. Their incidence and size are due to an unfortunate combination of low income and institutional and market failures, which undermine the correct operation of the housing market. These slums bring together a large number of people living in precarious conditions, in poorly constructed buildings with limited access to basic services and exposed to a multiplicity of environmental hazards. According to data from the United Nations' Global Urban Observatory, 21% of the total urban population in Latin America currently lives in slums. This figure has been in steady decline for the past two decades, down from 34% in 1990 and 29% in 2000.[13]

The design of public policies aimed at improving the living conditions of slum inhabitants require, as a starting point, a rigorous diagnosis. In other words, it is crucial to have statistical information on various aspects of the reality of these populations. Unfortunately, such information does not exist in most countries in the region. In an effort to fill this gap, the 2016 CAF Survey inquired about the demographic and socioeconomic situation of four slums located in Bogota, Buenos Aires, Caracas and Fortaleza.[14] Based on the results of this survey, a description of living conditions in these settlements is presented below. The rest of the urban population in the same city, referred to as "formal city" for simplicity, is used for comparison as a comparison group.

Living conditions

Table 4.5 (see p. 192) compares households living in slums with those in the formal city along three dimensions: household size and composition, access to basic services and tenure security. When compared with formal-city households, households in slums tend to be composed of a larger number of members and include a greater proportion of minors.

13. This number covers the percentage of the population living in housing units which fail to meet one or more of the following standards: access to tap water, access to sewer system, sufficient space (no more than three people per room), durability of the construction and tenure security.

14. For more details, see Chapter 1.

There is also a higher level of overcrowding, reflected in the traditional measure of the proportion of households with over three people per room, as well as in a lower consumption of space per household member. In terms of basic services, such as tap water, sewage and electric grid, the data reveals that access is more limited in slums than in the formal city. The same can be said for waste collection services (with the exception of Bogota, where practically all respondents living in slums reported access to this service) and access to natural gas through pipelines.

Despite several cases where the gap in access to basic services is not so conspicuous, important differences may occur in the quality of these services between slums and the formal city. If the frequency of service interruption is in fact a measure of (low) quality service, the deficit in slums is even greater: almost 3 out of 4 slum households report having suffered interruptions of more than 24 hours in the power supply or tap water supply during the last six months, while in the formal sector this figure is less than one third.

Table 4.5 Household characteristics by settlement type for selected Latin American cities [a/ b/]

	Buenos Aires			Fortaleza			Bogota			Caracas		
	Formal	Informal		Formal	Informal		Formal	Informal		Formal	Informal	
Size and composition												
Number of household members	4.0	4.7	***	4.1	4.1		3.9	4.2	***	4.2	4.3	
Number of households per unit	1.2	1.2		1.0	1.0		1.7	1.1	***	1.3	1.5	**
Households with children under 5 years old (%)	37	46	***	30	36	*	27	37	***	32	31	
Households with over 3 people per room	5	7	*	3	3		3	6	**	2	5	**
Square meters per person	23.8	13.0	***	17.0	12.2	***	26.4	18.4	***	27.3	14.7	***
Access to basic services (% of total households)												
Tap water	87	28	***	96	89	**	99	69	***	87	43	***
Sewage system	78	31	***	62	31	***	97	83	**	100	100	
Connection to public electric grid (billed)	96	49	***	99	93	***	99	82	***	90	79	**
Natural gas (via pipeline)	75	18	***	31	31		95	62	***	39	2	***
Waste collection	97	76	***	96	86	**	95	100	***	65	21	***
Declared tenure regime (% of total households)												
Home and land owner	65	60		53	48		54	66	***	50	58	
Homeowner but not land owner	4	12	***	13	27	***	10	0	***	38	18	***
Occupant with permission	8	16	***	4	2		3	7	**	4	9	**
De facto occupant	2	6	**	0	0		0	1		0	0	
Tennant	22	6	***	30	23	**	34	26	**	9	15	**

a/ The table reports average characteristics for households in each category, differentiating whether they live in formal or informal settlements.
b/ ***, ** and * report statistically significant differences (at 1%, 5% and 10% respectively) in the media or proportion (as appropriate) of households in each category.

Source: Authors' elaboration using data from the 2016 CAF Survey (CAF, 2016).

The data on housing tenure may come as a surprise at first glance: in both Caracas and Bogota the proportion of households that report ownership of the house and land is higher in slums than in the formal city; in Fortaleza there is no gap between both types of households and although the result is reversed in Buenos Aires, the difference is insignificant. This observation is incompatible with the fact that many slums are located in state-owned land or are the result of invasions of private land. Two factors account for this unexpected result: i) as a general rule, the percentage of rental households is higher in the formal city; ii) the proportion of households that report to be squatting the housing unit is predictably higher in the slums than in the formal city, although by a small difference (of a few percentage points). This seems to reflect a perception of de facto ownership by slum dwellers. Some factors that could be favoring this perception are the implicit recognition of the claims to the land derived from the provision of certain basic services, the time of permanence in the place and the consolidation of the neighborhood.

There seems to be a perception of de facto ownership by slum dwellers.

Table 4.6 Characteristics of housing location by settlement type for selected Latin American cities [a/ b/]

	Buenos Aires			Fortaleza			Bogota			Caracas		
	Formal	Informal		Formal	Informal		Formal	Informal		Formal	Informal	
Available amenities within a 10-minute walk or less (% of total households)												
Hospitals	49	63	***	63	63		27	13	***	35	30	
Schools	82	71	***	78	71		52	38		60	56	
Kindergartens	78	72	*	54	52		61	62		55	51	
Parks	75	61	***	65	54	*	65	37	***	44	24	***
Libraries	27	16	***	5	4		11	8		32	11	***
Sports centers	40	36		20	16		29	20	*	47	18	***
Available means of transport within a 10-minute walk or less (% of total households)												
Bus (formal)	96	89	***	96	95		67	54	*	71	67	
Bus (informal)	45	11	***	53	51		74	49	***	68	77	*
Subway	9	8		7	4		--	--		42	20	***
Train	28	17	***	8	3		--	--		22	6	***
Taxi	45	22	***	58	58		78	37	***	67	67	
Motorcycle-taxi/Bike-taxi	4	0	***	54	48		24	2	***	70	78	

a/ The table reports average surveyed characteristics of housing location for households in each category, differentiating whether they live in formal or informal settlements.
b/ ***, ** and * report statistically significant differences (at 1%, 5% and 10% respectively) in the proportion of households with access to amenities or means of transportation.

Source: Authors' elaboration using data from the 2016 CAF Survey (CAF, 2016).

As mentioned above, an essential feature of slum housing is its location, since it is associated, amongst other things, with accessibility to better jobs, services and amenities. Table 4.6 shows a clear advantage (in terms of accessibility to amenities and various means of transport) of households in the formal sector of the city with respect to those in slums. Almost without exception, households in the formal city enjoy, on average, better access to health services (hospitals),

education (schools and kindergartens), and to cultural and recreational spaces (libraries, parks and sports centers). The same is true for access to means of transport. However, the above does not imply that slum locations are undesireable for their inhabitants. On the contrary, such locations probably grant these households more accessibility than any alternative they could afford in the formal city.

Human capital and employment status

Table 4.7 compares households in the formal sectors and slums in terms of health status and education level, two essential components of human capital, and employment status, probably its most direct consequence. As for health, infrastructure and environmental conditions can affect the health status of residents. A dirt floor, for example, may increase the incidence of parasitic, diarrheal or infectious diseases (Cattaneo et al., 2009), while poor ventilation and the smoke from burning wood or other solid fuels in the stove for heating or cooking increase the incidence of respiratory problems (Hanna et al., 2012). However, despite a higher occurrence of these building deficits in slums, the survey found no substancial differences between slums and formal city households in the occurrence of infantile respiratory diseases, diarrhea and fever in the two weeks prior to the survey.

Table 4.7 Characteristics of health status, education and employment situation by settlement type for selected Latin American cities [a/ b/]

	Buenos Aires			Fortaleza			Bogota			Caracas		
	Formal	Informal		Formal	Informal		Formal	Informal		Formal	Informal	
Incidence of illnesses in children under 5 years old for two weeks prior to the survey (% of total households)												
Respiratory disease	7	15	***	19	12	**	15	14		19	16	
Fever	7	5		14	23	*	14	14		19	23	
Diarrhea	15	12		27	26		25	26		28	26	
Maximum educational level atainedc/ (% of total respondents)												
Secondary education completed	58	27	***	40	28	***	77	39	***	77	52	***
Post-secondary education completed	14	1	***	4	1	***	35	7	***	28	8	***
Employment Status [c/] (% of total respondents)												
Employed (%)	70	64	**	54	56		68	66		68	63	
Formal wage-earner (%)	76	53	***	83	75		85	74	*	78	90	**
Employed by a firm with 5 or more employees (%)	41	23	***	29	26		44	34	**	59	35	***
Median wage (USD PPP)	1088	653	***	458	447		802	545	***	1106	1264	

a/ The table reports average characteristics, differentiating whether people live in formal or informal settlements.
b/ ***, ** and * report statistically significant differences (at 1%, 5% and 10% respectively) in the proportion or median (as appropriate) of households in each category.
c/ Surveys for at-home respondents reported.

Source: Authors' elaboration using data from the 2016 CAF Survey (CAF, 2016).

There are, however, differences in the level of formal education, since the proportion of dwellers that have completed secondary or post-secondary education is lower in slums than in formal sectors for all of the cities surveyed. There are also differences in employment status. Slum inhabitants are less likely to be employed and, when employed, disproportionately access lower-quality jobs (measured either by legal status, by the size of the firm they work for or by their labor income).

The percentage of dwellers with secondary or post-secondary education is lower in slums than in formal sectors for all of the cities surveyed.

Slum formation and growth dynamics

A subject of great interest in the analysis of slums is their creation and growth dynamics. The population flow from the countryside to the city or between towns of varying sizes and even between countries is generally considered as an influential factor in the creation and growth of slums. Then there is the added factor of intrinsic demographic dynamics, through which the youngest family members form new families, who claim their own space. Text box 4.2 (see p. 198) describes the main characteristics of this dynamic based on qualitative interviews conducted in slums in some of the cities covered by the 2016 CAF Survey.

The reality of the four cities studied shows that it is not possible to identify a unique mobility pattern to explain these dynamics. As shown in Table 4.8, while in Buenos Aires and Bogota at least half of the population living in slums arrived through migration, this figure is barely 25% and 19% in Fortaleza and Caracas respectively. The slums of the four cities surveyed further differ in terms of the origin of the migrant population. In Buenos Aires slums, for example, 19% of the migrants come from abroad, while most of the migrants in the other cities come from rural sectors or from other cities in the country.

Table 4.8 Population origin by settlement type for selected Latin American cities [a/ b/]

	Buenos Aires			Fortaleza			Bogota			Caracas	
	Formal	Informal		Formal	Informal		Formal	Informal		Formal	Informal
International migrant	7	19	***	0	0		1	1		2	3
National migrant, rural origin	5	10	***	23	15	***	16	33	***	7	7
National migrant, urban origin	18	23	*	12	10		20	19		13	9
Non migrant	70	49	***	65	75	***	63	48	***	79	81

a/ The table reports origin of at-home respondents, differentiating whether people live in formal or informal settlements.
b/ ***, ** and * report statistically significant differences (at 1%, 5% and 10% respectively) in the proportion of people according to their migratory origin according to type of dwelling.

Source: Authors' elaboration using data from the 2016 CAF Survey (CAF, 2016).

The main reason to migrate is economic, followed by the presence of informal networks at the place of destination.

What drives the decision to migrate from one city to another? According to survey data, the main reason for migration is economic: 3 out of 10 recent migrants report that the fundamental reasons for migrating are job opportunities and conditions for entrepreneurship.[15] The second most important reason cited is informal networks (relatives or people from the same place of origin): 2 out of 10 recent migrants mention the possibility of reuniting with relatives and friends who already reside in the place of destination. In other words, these two reasons together account for half of the decisions to migrate to another city or country, both for slum inhabitants and for those dwelling in the formal city. Other reasons include educational opportunities, safety conditions and access to housing. The first two weigh more heavily among residents of the formal sector, while the third is more important among slum inhabitants.

When asking households about the time of residence in their current location, we can see that they are generally quite long, especially in slums. Over half of slum households in the four cities surveyed have resided in the neighborhood for over 23 years, with at least 20 years of residence in their current dwelling. In the formal sector of these same cities, over half of the surveyed households have been living in the neighborhood for over 20 years and at least 11 years in the same dwelling. On the other hand, 12% of the surveyed slum households have moved at least once in the past 5 years, a figure that triples for households in the formal sector.[16] Delving into the reasons behind these movements may provide useful information for the design of policy interventions.

When it comes to choosing between location alternatives within a city, defining factors include, among others: access to basic services, access to jobs, the possibility of enjoying certain amenities, networks comprised of relatives or people from the same place of origin, the neighbors' characteristics and the cost of housing. Graph 4.9 shows the reasons cited by households that have recently relocated (at least once in the last five years) for choosing their current neighborhood of residence. Both in slums and formal areas, closeness to family or friends comes first. The cost of housing comes second amongst slum dwellers, since the inhabitants of the formal areas tend to give more weight to the proximity to the workplace or their frequented destination. While other reasons, such as access to education and health services, access to means of transport and level of crime are considered important, they seem to take a second place for surveyed households.

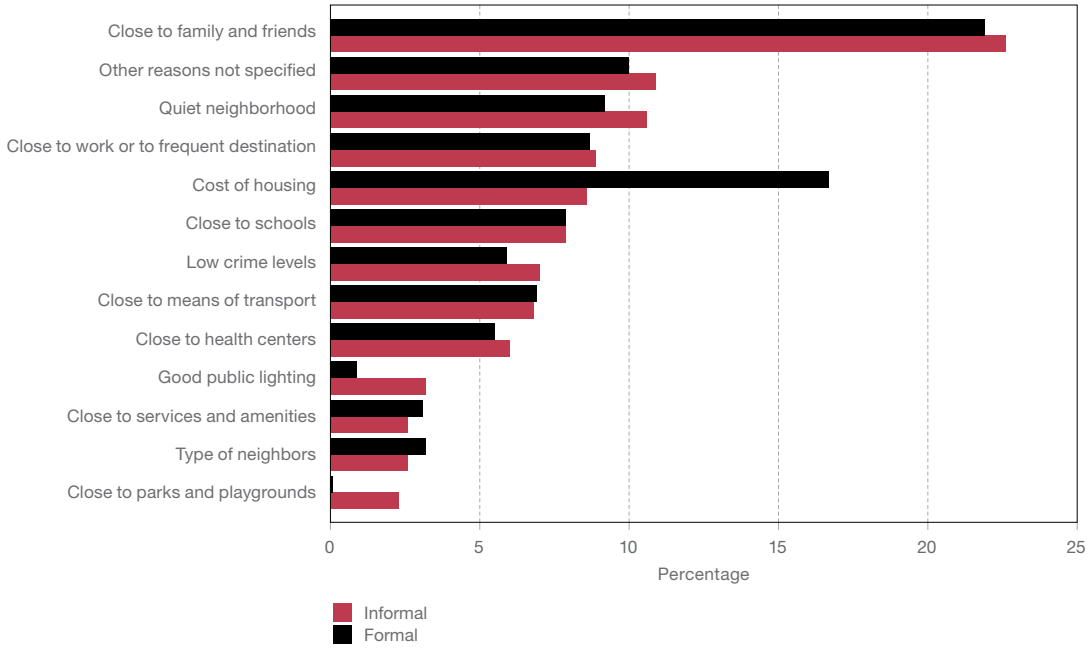
These attributes can also become decisive when deciding whether to live in slums or formal areas. The high housing prices, low and volatile income, and the scarce access opportunities to mortgage loans to finance the purchase

15. A recent migrant is defined as one who arrived (from another city or country) at their current neighborhood five years ago or less.

16. Almost half of these movements correspond to a change of housing within the same neighborhood, while the other half is divided between a change of neighborhood, city or country.

are factors that hinder entry into the formal sector of cities. Meanwhile, work and social networks offered by friends and family in slums, the flexibility to build outside the regulatory restrictions and the availability of informal financing alternatives increase the attractiveness of slums and explain the growing duality of the housing market.

Graph 4.9 Reasons for choosing a neighborhood by settlement type for selected Latin American cities [a/ b/]



a/ The graph reports the answers of at-home respondents to the following question: "Now think about your neighborhood: what were the main reasons for choosing this neighborhood?", differentiating whether they live in formal or informal settlements. The respondents could choose up to three reasons out of 13 choices. Because more than one reason could be chosen, reported frequencies are calculated on the basis of the total number or selected reasons (rather than the total number of respondents)..
b/ Cities: Buenos Aires, Fortaleza, Bogota and Caracas.

Source: Authors' elaboration using data from the 2016 CAF Survey (CAF, 2016).

Some of the factors that tip the balance in favor of slums are a direct consequence of public policy failures, such as the restricted supply of formal housing, the lack of a mortgage market aimed at the low-income sector and the inability of the transportation network to improve accessibility to peripheral areas. There are other issues that, albeit not directly caused by metropolitan management, can be affected by public policies. For example, lower-income families tend to build their housing progressively as their space requirements increase when new families appear within the household. This could be mitigated by a more dynamic and comprehensive housing market capable of easing access to housing for these new families.

Text box 4.2 Brief history of a slum[a]

As new households form in or arrive in a city, they are faced with a complex reality when the time comes to find a place to live in: i) big cities are already vastly edified; ii) prices in the formal sector are high due to a high demand for existing units and an inefficient construction industry that limits the rhythm of demand growth; iii) low and volatile income together with scarce access to mortgage loans deprive many families from the opportunity of considering housing in the formal area. Simultaneously, the existence of vacant public land or abandoned private land together with deficient state ability to contain informal subdivision of land encourage the emergence of an effective competition to formal housing. Thus, informal financing alternatives offered by illegal land realtors (such as the so-called Colombian "tierreros"), the flexibility of these options in terms of modifying and expanding the unit in the medium and long term, and –in some cases- the benefits derived from work and social networks which provide closeness to relatives and people from the same place of origin who are already established increase the appeal of these informal subdivisions of land. This shines a light on (or gives rise to) a clear duality in the housing market.

As time passes, the expectation of legal consolidation of these settlements increases. The low prices paid for the land or the initial constructions (which reflect the associated risk of remaining permanently marginalized) become a thing of the past, as the settlement of more and more households begins to drive the prices up, in response to the growing certainty that the neighborhood will eventually be recognized and become consolidated. The authorities' reputation of being in favor of regularization (through issuing land titles and investing in basic services infrastructure) or at least of maintaining a passive attitude by avoiding evictions feeds these expectations in squatters. As a matter of fact, governments try to avoid the strategy of forcing out entire neighborhoods due to its high economic and social cost, which only highlights the need to strengthen the state's capacity to prevent the formation of new settlements.

Once settled in, households begin a series of collective actions aimed at obtaining access to basic services. Access to basic services not only improves their quality of life, but is also perceived as a means of legitimizing the community, paving the way to the recognition and consolidation of the slum. Gradually, albeit deficiently, these basic services arrive, either because government agencies respond to collective demands or because the service suppliers act on the financial need to receive compensation once illegal connections are made.

The penetration dynamics of basic services usually depends on the type of service. Typically, better coverage levels are achieved for basic services whose individual illegal connection to a preexisting network is simpler, and whose benefits are of an essentially private nature (such as electricity, and to a lesser extent, water). On the contrary, the coverage for basic services of a rather more public nature is certainly lower and of poorer quality. This group includes streetlights, public safety, sewage networks and sewers.

At this point, some of the neighborhood's characteristics (particularly its location) determine the growth rhythm and its internal dynamics. For locations near business districts, or connected through transport networks, housing markets expand. The sense of security about the permanence on the land increases the market value of the units and favors the

appearance of a rental market. However, partial renting usually predominates in this scenario, with landlords occupying part of the dwelling as a form of insurance against usurpation of the house by the tenant. This reflects the fear associated with lack of tenure security, which persists in many cases even when the slum dwellers have arrived to a point where eviction becomes improbable.

With the slum's maturity comes the tightening of the community network and a growing sense of belonging. This, together with the limited economic possibilities of many of its inhabitants, encourages construction dynamics destined not only to building for rent, but also for the benefit of the new generations that form their own homes. Thus, the space (both vacant lots and open spaces from the original subdivision) begin to fill up, vertical growth increases, and density far outweighs the one in the formal part of town, up to the point of overcrowding.

a. This text box was written based on a qualitative survey on slums carried out by CAF in five Latin American cities.

Transient situation or poverty traps: What expectations suggest

At some point in their history, some of the richest cities today, such as London, New York or Paris, featured precarious neighborhoods populated mainly with the arrival of rural immigrants attracted by the economic opportunities generated by the Industrial Revolution. However, the urbanization of these cities was followed by increase in income level, which favored urban marginality only as a transitory phenomenon between the arrival of rural low-income immigrants to the cities and their effective integration into the formal system.

However, as described in Chapter 1, urbanization and its relation to income level have changed drastically since the mid-twentieth century, giving way to a phenomenon of rapid urbanization that has not been coupled with similar growth of income levels. In this context, the concern is that Latin American cities are currently facing the problems of large cities (specifically urban informality) without the economic and institutional resources that were then available for developed countries. Thus, the precarious living conditions offered by slums could be real poverty traps, with self-perpetuating low income and limited opportunities.

There is evidence to support the characterization of slums as poverty traps. Marx et al. (2013) show that income in slum households in Kenya and Bangladesh remain constant or even decreases as the time of permanence in the neighborhood increases. Nevertheless, dynamics may vary greatly between countries (also between settlements within the same country). The authors point out that in the

The percentage of people who expect to complete their secondary or post-secondary education is lower amongst slum dwellers when compared with the formal city.

last few decades, from a comparative standpoint, Mexico, and to a lesser extent Brazil, have performed well in terms of slum incidence: between 1990 and 2007 the urban slum population decreased over 10% in Mexico, and although in Brazil it increased around 10%, this figure is below the rate of total urban growth, of approximately 40%.

Unfortunately, the lack of data prevents a better understanding of work and life trajectories in slums across the region. However, based on the 2016 CAF Survey, Table 4.9 summarizes information on slum dwellers' expectations regarding educational achievements, quality of life and housing, compared to those of formal city dwellers. In terms of education, the percentage of people who expect to complete their secondary or post-secondary education is lower amongst slum dwellers when compared with the formal city. Fortaleza is an exception, with equal expectations regarding educational progress amongst the two types of urban dwellers. When it comes to expectations of improving quality of life in the future, only the slum dwellers from Buenos Aires appear less optimistic than their formal urban counterparts. For the rest of the surveyed cities, there are no significant differences.

Table 4.9 Household expectations by settlement type for selected Latin American cities [a/ b/]

	Buenos Aires			Fortaleza			Bogota			Caracas		
	Formal	Informal		Formal	Informal		Formal	Informal		Formal	Informal	
Educational expectations (% of people who have not completed each educational level)												
Complete secondary education	51	28	***	41	42		59	61		36	19	***
Complete post-secondary education	33	16	***	28	25		57	47	**	32	12	***
Quality of life expectations (% of total households)												
Improve quality of life in the future	55	43	***	84	85		77	80		47	51	
Expectations of moving out of current housing unit (% of total households)												
Move to another housing unit in the same neighborhood	28	23		40	27	***	17	30	***	53	55	
Move to another neighborhood in the same city	32	46	***	28	47	***	27	35		28	27	
Move to another city or country	40	31	*	32	26		56	35	***	18	17	

a/ The table reports the average characteristics of respondents, differentiating whether they live in formal or informal settlements.
b/ ***, ** and * report statistically significant differences (at 1%, 5% and 10% respectively) in the proportion of people or households.

Source: Authors' elaboration using data from the 2016 CAF Survey (CAF, 2016).

In order to evaluate whether slums constitute poverty traps or, on the contrary, are the transitory residence for those migrating to the big cities in search of better opportunities, one would ideally track the evolution of slum citizens' potential for generating income over a period of time. Unfortunately, there are no databases keeping track of data from slum inhabitants. An approximation would be to compare income between individuals with varying time of residence in a slum.

This comparison appears biased, however, because only those with the lowest income generation potential could be seen among the oldest cohorts (those with more years of residence in the slum), as individuals with higher income are expected to have moved out of the slum.

The percentage of tenants in the surveyed slums ranges from 7% in Buenos Aires to 29% in Bogotá.

To better understand living dynamics in slums, it would be helpful to have information tracking households through time and monitoring their migration. A side conclusion to be drawn from this section is the urgent need to invest in the development of longitudinal databases that allow a deeper study into the reality of slums in South American cities.

Rent in slums

The high degree of ownership perception of inhabited housing units could establish the minimum basis for the existence of a relatively dynamic informal housing market. House rental, or partial house rental, is one of the possible manifestations of these markets.[17] In fact, the proportion of tenants in the surveyed slums ranges from 7% in Buenos Aires to 29% in Bogota (see Table 4.5, p. 192). Table 4.10 describes some characteristics of the tenant-landlord relationship for both slums and the formal city. In the former the relationship is less likely to be legalized through a leasing contract, the contract is more likely to have risen through a previous connection between parties and it is less common to use collateral of any kind. In other words, the slum rental market is rather informal, where word agreements predominate, facilitated in many cases by a previous link between parties, and more likely to be legitimated by habits and customs than by existing regulations.

Table 4.10 Characteristics of rental arrangements by settlement type for selected Latin American cities [a/ b/]

	Buenos Aires			Fortaleza			Bogota			Caracas		
	Formal	Slum		Formal	Slum		Formal	Slum		Formal	Slum	
Tenants												
With leasing contract (%)	78	31	***	48	28	***	67	28	***	49	39	
Had a previous connection to the landlord (%)	43	61	**	63	75		41	67	***	66	85	**
Provided or signed a collateral (%)	58	9	***	47	40		33	13	***	30	36	

a/ The table reports the percentage of tenants in each category, differentiating whether they live in formal or informal settlements.
b/ ***, ** and * report statistically significant differences (at 1%, 5% and 10% respectively) in tenants.

Source: Authors' elaboration using data from the 2016 CAF Survey (CAF, 2016).

17. Another manifestation is the sale of properties. Qualitative survey conducted in slums in these four cities by CAF 2016 reveal the existence of a relatively dynamic housing market.

Policy guidelines to improve access to housing

The definition of objectives

Universal access to quality housing is often perceived (and in many cases legally required) to be a responsibility of the State. In order to effectively direct efforts towards this goal, it is essential to understand the causes underlying the existing gaps. The previous sections have highlighted the importance of distinguishing between supply and (low income) demand factors behind the region's housing deficits so that the appropriate corrective measures can be implemented.

Supply factors relate to the bottlenecks that hinder the production of housing units, such as scarcity of land, regulatory and bureaucratic restrictions, insufficient infrastructure in transport and other services, the lack of competition in the construction sector and in the inputs market, amongst others. But even if we assume that the housing market operates efficiently and there are no supply constraints, some sectors of society might still live in sub-standard housing units due to their low income. In this sense, housing deficits are another manifestation of poverty levels. To improve the living conditions of these segments of the population, the State can apply redistributive measures. Housing policy is in fact often used as a redistribution mechanism. Text box 4.3 contains a brief discussion on the relative merits of this strategy.

To be effective, redistribution efforts must meet two conditions. First, they need to focus on the low-income families whose access to housing is to be promoted. Indiscriminate policies (such as controlling rents or mortgage rates) that distort the housing market should be avoided. Second, they must be supplemented with corrective measures that allow for a relatively unfettered housing supply. To illustrate this point, let us imagine an extreme case where housing purchase is subsidized while simultaneously banning the construction of new units. In this scenario, the subsidy would translate entirely into higher prices, without driving changes in the housing services available to the subsidized population.[18]

18. A policy that stimulates the housing supply does not imply the elimination of all types of regulation for residential development. There is margin for establishing regulations to reduce congestion costs and negative externalities of population growth.

Text box 4.3 Housing as a vehicle for redistribution

An important issue regarding redistributive policies has to do with the relative benefits of providing goods and services to the lower-income sectors vis-à-vis the alternative of handing them both the money and the possibility to own the decision on how to spend it. In practice, it is much more common to see distribution in the form of goods and services than in cash, and housing is one of those goods that is often used for redistributive purposes (for example, housing projects for low-income households subsidized by the State). The reason behind the relative prevalence of this type of transference is not necessarily obvious. In fact, many economists argue for the superiority of redistributing money, since this allows households to use it in the way that better suits their needs. The transference of goods and services, they argue, results in inefficient levels of consumption. In other words, if the State transferred low-income households an amount equivalent to the value of the property, instead of giving them a house, there would be households that perhaps would not buy a house with those characteristics, but would instead distribute the money in a different way (even purchasing a different kind of house).

The evidence from several conditional cash transfer programs is compatible with this idea. Attanasio and Mesnard (2006), for example, study patterns of consumption in the beneficiaries of the Colombian program Familias en Acción (Families in Action), and find that recipient families increase some consumption items such as food, clothing and education, without modifying housing consumption in both rural and urban contexts. This is probably a reflection of those households' priorities.[a] [b]

How does one explain, then, the high incidence of redistributive policies in goods and services? An initial argument would suggest that low-income households do not have the capacity to invest their money in the most convenient way, while the State knows better than the individuals themselves the adequate levels of consumption. A spin on this argument points out that in-kind transfers (including housing subsidies) respond to taxpayer preferences and their beliefs about the most pressing needs of lower income sectors. Alternatively, it is argued that in-kind transferences are a way of guaranteeing that redistribution benefits reach the children in those households with unsatisfied needs. The theoretical basis behind this argument is that different types of transfers affect the allocation of resources within a household differently, since the individuals within the household might have different spending priorities.c In this scenario, it is essential to define who receives the benefit and what are the odds that other household members might misappropriate it. Transfer of goods is in general less likely to be misappropriated by other household members when compared with money transfers. Therefore, if parents failed to fully internalize the benefits that housing entails for their offspring, the provision of housing would be a way of guaranteeing that children consume an optimal level of housing services.

There is a second argument relative to the monitoring capacity of the beneficiaries. If the monitoring system is deficient, money transfers would have a disadvantage: they would hinder the accurate identification of the target population, since the entire population, regardless of their income level, would have an incentive to claim the benefit. In-kind transfers (particularly in the form of housing) can alleviate this problem. However, paradoxically, this is true only to

the extent that housing is of a sufficiently low quality that it will not motivate higher-income households to claim it.[d]

In conclusion, the superiority of one form of redistribution over the other is not obvious. Additional empirical evidence is needed on this subject. Nevertheless, it is essential to underline that, since housing programs impose a certain level of consumption, they require a very sophisticated implementation. When the State carries out investments that do not reflect citizen preferences, there is a risk of ending up with abandoned constructions with unrecoverable costs.

a. The transferred amounts are certainly small. However, preferences for improved housing could materialize in spending on fixtures and investments, or in renting a higher-end housing unit.
b. Money transfer programs (specially the conditional cash transfer mode) have been gaining traction in the past few years. Nowadays, several developing countries (including some in Latin America) have implemented this kind of strategy.
c. Empirical literature suggests that women choose to invest more heavily on children than men (Duflo 2012).
d. Nevertheless, even this condition may prove insufficient if there is a secondary market were the beneficiaries can sell the units.

It is also important to discuss the relevance of rental markets. Housing policy has had a marked bias towards promoting ownership, while policy makers have largely overlooked the residential rental markets. Although not exclusive to Latin America, this predisposition towards property has been notorious in the region.

Based on the evidence available in specialized literature, Text box 4.4 presents arguments for ownership. There is a lack of robust evidence, however, to show that ownership provides superior social benefits as opposed to renting. This, together with the fact that the rental market can be a useful tool to improve the housing situation of certain segments of the population, suggests the need to reconsider some aspects of housing policy. Specifically, it should aim at the goal of universal access to housing rather than tenure ownership. This in no way supposes to disadvantage the owners or those who aspire to be owners. On the contrary, universalization implies executing a policy whose objective is to maximize household access to housing, without any bias as to the forms of tenure.

Text box 4.4 To be or not to be a homeowner: the debate between buying or renting

An argument in favor of ownership states that, from a financial point of view, it is always preferable to buy than to rent. It is also suggested that ownership increases personal satisfaction and promotes a higher involvement with the community, which has a positive effect on society. Existing evidence, however, seems incongruent with these statements.

The financial benefits of home ownership depend on many factors. For most people, buying a house requires a loan, which in turn involves paying mortgage interests.

Multiple variables beyond mortgage interest rate (including expectations for housing capitalization, alternative investments profitability, the tax system and rent fees among others) need to be considered, so that the financial suitability of the purchase is not guaranteed and depends on the context. Most markets certainly show a secular rise in house prices and the general perception is that a house is always a safe bet. Episodes such as the housing market crisis in the 2000s shows this to be a questionable belief. Moreover, some economists have postulated that widespread expectations of increases in the house prices can, by themselves, lead to price increases and real estate bubbles.

The housing market crisis of the decade of 2000 highlighted another disadvantage of ownership: the risk associated with the low financial diversification of homeowners. In most of these households, their housing unit represents a high percentage of their wealth, therefore generating a high exposure to the volatility of the housing market and to potentially significant losses of wealth in the event that prices drop.

Many government policies aimed at favoring ownership focus precisely on diminishing the economic cost of acquisition, altering in the process the balance between buying and renting. An example of this situation is subsidies to mortgage rates and preferential taxing of mortgage interest payments. This type of program, however, does not only have efficiency costs (since it changes the price balance and affects the individuals' decisions), it also has distributive costs (because middle and high-income households have the possibility of acquiring mortgage debts and to benefit from the subsidies).

Perhaps the argument in favor of ownership that has become most popular in the specialized literature refers to its non-pecuniary advantages. Several studies have found a positive correlation between ownership and variables such as household health levels and children's cognitive development. DiPasquale and Glaeser (1999) found that homeowners have higher levels of involvement in their community and higher investment in social capital. The main problem with this observation is the inability to refute the hypothesis that the observed correlation can be accounted for by preexisting differences between those households who are homeowners and those who are tenants. It is also important to point out that the effect can be largely explained due to the fact that homeowners spend more time living in their communities (the probability of moving to another neighborhood diminishes with home purchase) and not due to the type of ownership. On the other hand, the reduction in geographical mobility of homeowners makes these households more vulnerable to changes in the local labor markets. As a matter of fact, many authors have focused in studying the relationship between homeownership and employment, with contradictory arguments. Nor is the empirical evidence conclusive. In a recent study, Navarrete and Navarrete (2016) used a quasi-experimental design to evaluate the causal effect of an ownership promotion program in Chile on the employment situation of individuals. The authors report that tenure ownership reduces employment by 4 to 5 percentage points, and amongst the possible mechanisms identified by the study, are the increase in monthly non-labor income together with an increasing burden of household chores.

In addition to the fact that there is insufficient and unconvincing evidence to support homeownership as a superior form of tenure, there are several reasons why public

policies should aim to boost the rental market. First, as mentioned earlier, home ownership supposes a major investment that excludes a large sector of the population due to the absence of considerably sized subsidies. Rent becomes consequently the natural option for many low and medium-income households. This requires activating a broader market and encouraging investment in the construction of units designed for this purpose, as well as their maintenance. Second, household composition is closely linked to the type of tenure. For example, the purchase of a house is traditionally associated with forming a family. The housing market should therefore reflect the social changes in household composition, such as current trends towards greater prevalence of single-person households, the postponement of the decisions to marry and have children, and the increase in the geographical mobility of young people, which point to the need for a rental market that responds to changing demand.

First order of business: Unlock housing supply

The conceptual discussion and empirical evidence presented in this chapter suggest that public policies should prioritize increasing residential housing supply. In fact, in most countries of the region the rate of construction of new housing is not sufficient to cover the increase in demand. Furthermore, according to data from IDB (2012), during the decade from 1997 to 2006, in Argentina and Colombia the number of new formal dwellings was below the number of new households created.[19] To that effect, the fundamental question is: Why are there not more construction works being developed in Latin America?

An important barrier to construction is the scarcity of developable land, due to both the natural boundaries of the city (its geographical features) and regulations that limit residential development. From a public policy standpoint, there should be a greater focus on regulatory restrictions, since they are susceptible to intervention. Mountains and coastlines offer limited room for negotiation.

Given the growth of demand, the expansion of the urban perimeter is a first leeway to housing supply. Geographical limitations considered, public policies can actively influence the extension of developable land in a city. Far from fixed, urban sprawl can be modified through investments, particularly in the sphere of transportation infrastructure.

19. In contrast, Chile struck a balance between both variables.

The expansion of the urban perimeter and the increase in the density of construction allow adjusting the housing supply to an increase in demand.

The decisive element in assessing whether a plot of land is suitable for urbanization is its economic relevance, which can be achieved through the provision of connectivity with the economic life of the city. To better picture this point, several authors point out the role played by the construction of highways, roads and railroads in the United States and China, directly affecting the shape and size of the cities (Baum-Snow, 2007; Baum-Snow et al., 2017). This happens because the decisions on where to locate housing follow the network that provides access to the city's benefits, which renders the amount of economically attractive land for residential purposes a function of the public transport system.

This evidence together with the fact that city sprawl has grown steadily as urban density decreased (see Chapters 1 and 2) apparently points towards the convenience of investing in transport networks (and other services) on the periphery of cities. However, this concept clashes with an explicit objective of municipal planning in many Latin American cities that seeks to contain the expansion of the urban footprint.

A second coping response to the expansion of demand is to increase the density of construction within the urban perimeter. However, there is an extensive set of regulations that can limit residential density. In many cases this is precisely the goal of these regulations. There are legitimate reasons to impose certain constraints on the growth of housing supply, because new developments often generate negative externalities to neighbors of existing units in the form of increased congestion and pollution. Capping construction, however, impacts housing affordability through price increases. Causality between regulatory restrictions and increased housing prices has been categorically established with empirical evidence.

Based on the two previous points, it should be noted that the imposition of simultaneous restrictions on residential density and urban sprawl can be particularly detrimental to the housing market, since it closes the means of adjustment to the expansion of housing demand.

Due to the variety of measures that may (intentionally or unintentionally) affect residential construction, it is difficult to assess the severity of the overall regulatory framework. Gyourko et al. (2008) propose - and calculate for the United States - an index that synthesizes regulatory complexity, thus allowing to rank districts according to how restrictive they are on construction processes.[20] They conclude that the most restrictive policies are associated with more expensive housing markets. Research of this type is scarce in Latin America, with the exception of Goytia et al. (2015b), who estimated a "regulatory environment" inspired by Gyourko et al. (2008) for Argentine

20. It is impossible to talk about an "optimal" level of regulation, since the theoretical tools that define it do not exist. It has in fact been pointed out above that restrictive measures carry advantages and disadvantages. An excessive level of regulations carries the benefit of palpable results (in terms of lower congestion, less overcrowding, better view, etc.) versus less palpable costs (driving up costs, inefficient geographical distribution of individuals).

Inefficiencies in the permit approval process can also affect housing production, by impacting the costs of residential developments.

municipalities. They discovered that municipalities with the strictest regulations are characterized by a greater number of actors involved in decision-making, more expensive approval processes, and bigger delays in approving regulatory changes. Local characteristics that correlate positively with regulatory severity include community income level and percentage of adults with post-secondary education.

In another study, the same authors found that regulation apparently does not respond to considerations of wellbeing (such as mitigating negative externalities) or to homeowner preferences (who would limit new constructions so as to benefit fromincreases in housing prices), but is motivated by exclusion (strict regulations are imposed to exclude groups of potential residents, mostly low-income sectors). This is a fundamental discussion, since land use regulation has important distributive effects, and is consequently likely to be used to favor certain sectors of society in detriment of others. Much more research is however necessary to clearly understand the determinants of housing policies (Goytia et al., 2015a).

In addition to the strictly regulatory components, factors such as inefficiencies in the permit approval process can also impact housing production, since they increase the cost (monetary or in time) of residential developments. An example of this is the complex and expensive process of property registration characteristic of many countries in the region (IDB, 2012). In certain cities, these bureaucratic obstacles can prove more detrimental than regulations. Urban developers in the main Argentine cities, for example, state that the multiple bureaucratic obstacles that are part of the application and approval process for land subdivision and their high cost are responsible for the low private investment in housing development for medium and low-income sectors (Ronconi et al., 2012).

During the latest edition of the CAF report, a survey was sent to the urban planning offices of a selection of cities in Latin America. The survey asked, amongst other things, to what extent a number of factors (legal, institutional, economic, etc.) impact the rate of housing construction in their cities. The responses were greatly varied in this regard, with the three most commonly identified high-impact factors on construction rate being:

- The duration of the zoning or regulation change process.
- Pressure on basic services and communal infrastructure.
- Legal restrictions on residential density.

This set of factors illustrates the different dimensions in which the State can intervene in favor of a more flexible housing supply. The fist factor points precisely at bureaucracy. The second refers to the relationship between the housing market and investment in public services (schools, hospitals, parks, etc.). Population growth effectively puts pressure on existing public infrastructure; therefore, investment directed at increasing the availability of these services is also key to expanding housing supply. Finally, the third factor points at the strictly regulatory aspect.

Market duality

By affecting the formal housing market, regulations can make formal housing more expensive and encourage the appearance of slums.

As pointed out earlier, the literature on the effects of regulations on housing markets has focused almost exclusively on the US case. There is, however, an important difference in Latin American countries: the prevalence of dual housing markets, with a large portion of the population living in slums. In this context, it is possible that restrictions on housing production produce collateral effects unknown to developed countries. It is the case with regulations, which, by affecting the formal housing market, can make formal housing more expensive and encourage the appearance of slums and the growth or existing ones. Although this applies to the regulatory environment in general, Text box 4.5 illustrates how specific policies can enhance housing market duality.

Preliminary evidence favoring this hypothesis can be found in Brazil. Biderman (2008) shows that the regulations associated with land zoning and division influence the formation of slums. Alves (2016), on the other hand, estimates that in Brazilian cities the elasticity of housing supply is bigger in the informal sector than in the formal sector. This is compatible with the hypothesis that legal and bureaucratic restrictions bear disproportionately on the formal sector, rendering a comparatively more dynamic informal market. Goytia and Pasquini (2016) have also found in Argentina a positive relation between regulatory requirements and growth of informal settlements.

Text box 4.5 Collateral effects of regulation: The case of minimum-sized lots

The relationship between income and demand for space (discussed in detail in the sub-section “Housing Consumption”) helps to illustrate how some regulations designed to improve families’ housing situation can end up being counterproductive. For example, it is common for administrations to impose certain requirements on the space occupied by housing units (such as minimum lot or housing unit size). These types of regulations are intended to ensure that individuals have “enough” space in their residence. Their intention is, no doubt, good and understandable, since overcrowding has perverse effects on important variables such as school performance in children. However, it is also true that larger housing is more expensive, and consequently such regulations can result in housing becoming unaffordable for low-income households. This in turn forces these households to seek alternative ways of meeting their needs, such as informal dwellings that do not comply with those regulations. In this way, rather than guaranteeing universal access to a minimum set of conditions that are required by regulation, construction requirements can end up encouraging informality in house ownership or rental.

In this context, the existence of an informal sector reduces the efficacy of construction restrictions aimed at controlling population growth (a common

objective in these policies). Feler and Henderson (2011) suggest that in the face of ineffective legal instruments, Brazilian municipalities resort to alternative mechanisms to restrict the settlement of low-income immigrants. To this end, they argue that municipalities have strategically reduced tap water and sewer system supply in those areas more prone to the formation and growth of slums. This insight agrees with the observation made by Goytia et al. (2015a) regarding the grounds for exclusion that underlay certain construction regulations in Argentina.

In conclusion, although more evidence is needed to clearly understand the consequences of land use regulation on urban informality, existing studies suggest that increasing flexibility and reducing bureaucratic processes associated with residential development, together with the simplification of the regulatory framework, could go a long way in diminishing the proliferation of slums.

Expand the rent market

As with any other market, the increase in the number of units for rent is the main way to reduce rental prices. Text box 4.6 offers an example of the close relationship between number of units listed and leasing fees. The expansion of supply could arise mainly via two sources: i) finished housing that is currently vacant could enter the rental market with the appropriate incentives in place, ii) the development of new housing units built specifically for rent, an almost non-existent formula in Latin America, but of relative popularity in other regions.

As for the first point, there are few estimates of the number of vacant housing units in the region's cities. It should be additionally considered that not all vacant housing units are necessarily open to entering the market. However, available data on the subject would indicate there are a significant number of such units, which would merit designing the appropriate incentives to encourage their inclusion in the housing market. According to data from the Housing Finance Information Network (HOFINET), 14% of Mexican housing units (approximately 5 million units) were vacant in 2010. In the same perior, the corresponding number was estimated at 10% for Brazil, 8% for Panama and 6% for Colombia.

The level of unit vacancy can also be a direct consequence of economic policy. An example of this is the implementation of rental fees control and legislation that hinders the eviction of tenants who owe rent. These regulations are usually designed to protect tenants, but they negatively impact landlords' willingness to offer their properties for rental (at least through the formal channels). This type of regulation helps explain why some landlords with several units for rent would rather leave vacant units than rent them, or they make such high demands when closing rental contracts, that it increases the time units remain vacant. In this sense, if we aim at favoring the expansion of rental markets, the first step is to correct existing regulatory imperfections.

Text box 4.6 The rental market in Argentina

According to a study by Cruces (2016), which explores the case of the Argentine real estate market in 2003-2012 in the aftermath of the economic and political crisis of 2001, the confidence of the country's economic agents in traditional saving instruments plummeted, stimulating an increase in the use of real estate investment as an alternative saving mechanism. As a matter of fact, while during the 1990s for every dollar invested in real estate there were 6 dollars in bank deposits, between 2003 and 2012 this ratio became almost 1 to 1. This resulted in an accelerated pace of construction, which had an impact on the rent market. On the basis of electricity consumption, the paper estimates that 6% of new units were vacant, suggesting that most housing units entered the rental market. During the period of observation rent prices dropped accordingly by approximately 40% in real terms.

This study highlights the negative relationship between the housing supply in the rental market and market return. However, in this specific case, the trigger for the increase in supply was society's strong distrust in traditional saving instruments, which explains why the aggregate economic effects were not necessarily positive.

Regarding the second point, the implementation of residential projects designed for rental has been barely tried out in the region, which contrasts with its relative popularity in more developed regions. In the years following World War II, with an environment characterized by considerable housing shortage and widespread poverty, European countries made public investments in the housing niche for rent. Over time, the population's increased income and financing facilities have led to a reduction in the rental sector, although it continues to be quite significant in some countries. Eventually the paradigm shifted away from the design of incentives for private investment in housing for rent towards publicly subsidizing demand. Latin America, on the contrary, has done little to encourage a growth in the supply of housing units for rent.

A possible explanation for this situation is that residential development for rental have long profit horizons, which in a context of macroeconomic instability discourages this type of investment. Ensuring a stable economic environment therefore becomes a necessary condition for the sector to grow. It is additionally important to encourage the development of stronger credit markets to leverage this type of investment. An additional obstacle for securing investment in housing for rental is that they are perceived as riskier than developing housing for homeowners. As noted above, this perception is linked to the uncertainty of rental income flows generated by regulatory obstructions (such as difficulty to evict).

During the late 1980s an ambitious program of fiscal incentives for the construction of low-cost rental units was implemented in the United States, in

In order to promote access to housing it is essential to create a broad and efficient credit sector.

order to increase supply for low and middle-income families. Results are mixed, since on the one hand the program has led to the construction of a significant percentage of the private rental units in the country,[21] but on the other, some critics argue that much of the demand generated by the program has replaced private demand and the net growth is rather low. Critics additionally point out that the real estate developers captured a substantial part of the subsidy, transferring next to nothing to final consumers (Deng, 2007; Glaeser and Gyourko, 2008; Eriksen and Rosenthal, 2010).

Demand policies

The demand for housing has a very stable and predictable behavior across all societies. Since housing is a basic necessity, every household will demand one. In addition, as covered above, amount and quality of housing correlates positively with income. From a demand perspective, the main obstacle to the effective consumption of housing services involves their financing.

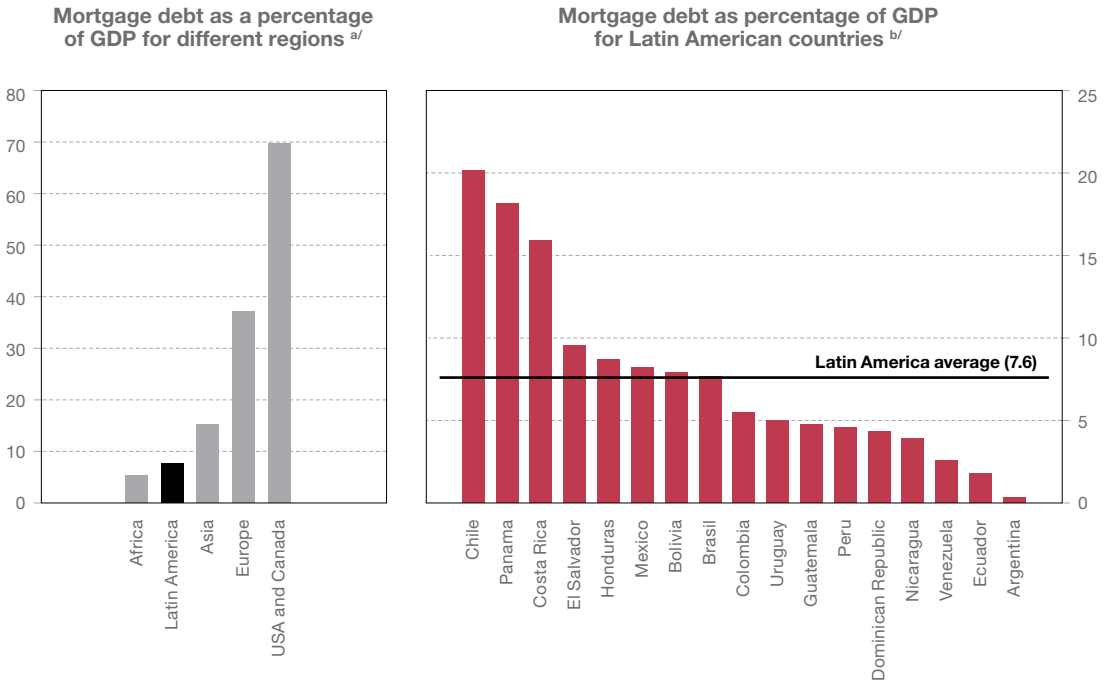
Housing is indeed a costly asset. Most families require access to long-term credit to finance their purchase. It is therefore essential to create a broad and efficient credit sector that favors access to housing. In the absence of credit, many households must resort to incremental construction or settle for low-quality housing, since the acquisition of a home with their own savings is a luxury available to a few (Chiquier and Lea, 2009).

House mortgage is a natural way of financing a house purchase, since the durability of the purchased asset makes it a good collateral. Mortgage financing is a relatively recent phenomenon that has become increasingly popular in the last few decades, with greater strength in developed countries than in emerging markets. Graph 4.10 exhibits that mortgage debt as a percentage of gross domestic product (GDP) –which accounts as a measure of the sector's size– was around 37% for Europe by 2015, while for the United States and Canada it rose to 70%. In contrast, in Latin America, Chile has the most robust mortgage market, with a debt stock equivalent to 20% of its GDP, while Brazil and Mexico, the two biggest economies in the region, have much lower values, close to 8%. Data on Argentina shows an almost nonexistent mortgage market.

A prerequisite for the growth of the mortgage sector is macroeconomic stability. Strong economic turmoil in Latin America has proved detrimental to the flourishing of the sector, and has in some occasions wiped out the progress made. Hyperinflationary episodes have been particularly damaging in this sense. High levels of inflation, as well as its variation, increase the risk involved in making long-term loans. Therefore, the first recommendation for drafting policies aimed at encouraging the mortgage market is to foster a macroeconomic environment with enduring predictability.

21. Gyourko and Glaeser (2008) estimate that this program was responsible for the construction of at least a third of the private units for rent in the United States between 1995 and 2004.

Graph 4.10 Mortgage debt, as a percentage of GDP for different regions and for Latin American countries



a/ For details on regions, see Appendix.
b/ The data used for each country is dated as follows: Argentina (2015), Bolivia (2013), Brazil (2013), Chile (2014), Colombia (2015), Costa Rica (2015), Ecuador (2013), El Salvador (2012), Guatemala (2013), Honduras (2013), Mexico (2014), Nicaragua (2013), Panama (2013), Peru (2015), Dominican Republic (2015), Uruguay (2010) and Venezuela (2013).

Source: Authors' elaboration using data from HOFINET (2017).

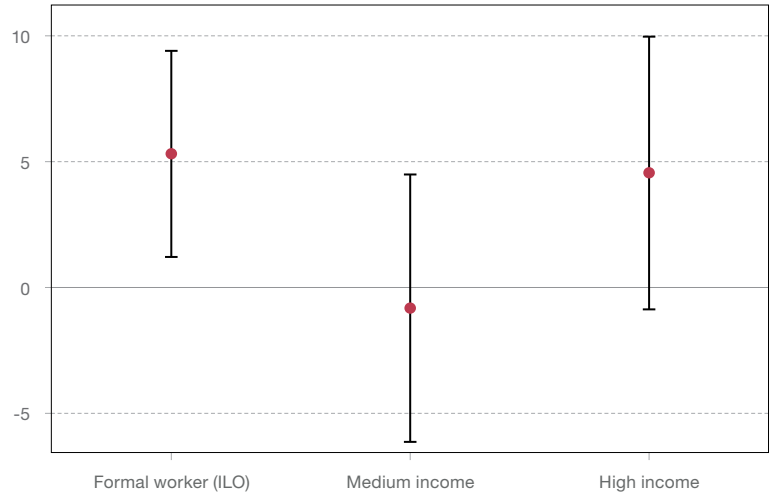
At a more specific level, there is a set of institutional and regulatory elements needed to stimulate a healthy mortgage financing system. In particular, the State should: (i) secure property rights and provide a good property registration system; (ii) guarantee the foreclosure of mortgages on behalf of mortgage holders in the event of default; (iii) establish a transparent credit report system; (iv) promote the training of professional brokers in the housing market, particularly of property appraisers; and (v) promote the development of a secondary market (for mortgage securization) that provides liquidity and contributes to manage the implicit risk in the mortgage business (Warnock and Warnock, 2008; Chiquier and Lea, 2009). Although this list is far from thorough, adhering to it is vital to the expansion of the mortgage market by reducing the uncertainty inherent to such transactions.

Even if the supply of mortgage credit worked efficiently, there would still be parts of the population that would remain unattended by the mortgage market: informal workers and families with very low income. Labor informality is associated with more volatile and less easily demonstrable income, which hinders access to credit and therefore generates a double labor-housing informality that is very common

Breaking the double cycle of labor-housing informality requires innovative mechanisms to determine the credit status of informal workers.

in Latin American cities. Evidence indicates that labor formality is determinant when aspiring to credit even after controlling for income level. Graph 4.11 shows that the probability of obtaining a mortgage loan is 5 percent points higher for formal workers than for informal workers.[22]

Graph 4.11 Effects of labor informality and income level on access to credit markets for 11 Latin American cities [a/]



a/ The graph reports the coefficients and 90% confidence intervals of a regression of access to the credit market on indicators of labor informality and income levels. The dependent variable is dichotomous and takes value of 1 for households whose head reports a bank loan as the main source of funding used to buy their home. Labor informality is measured through a dichotomous variable that takes value of 1 for households where the head works in organizations of less than five employees. Income levels are measured through a categorical variable that takes one of three values, according to the tertile of income distribution to which the head of household belongs for each city. The regression includes observations from households that live in the formal city and own the dwelling they inhabit. The category of households whose head is an informal worker with "low" income (lower tertile) is omitted. The "formal worker" coefficient indicates the differential access to credit of formal versus informal workers.

Source: Authors' elaboration using data from the 2016 CAF Survey (CAF, 2016).

Breaking the double cycle of labor-housing informality would hypothetically allow access to credit markets to those self-employed or informal workers with sufficient income but with little or no ability to demonstrate it. This requires innovative mechanisms able to alleviate information asymmetries and enable mortgage holders to access relevant data on the creditworthiness of informal workers and their household, thus generating flexible and novel mortgage instruments. An example of this is the assembly of credit records based on information regarding the payment of basic services or rent, as done by non-banking financial institutions in Mexico and the Government Housing Bank of Thailand.

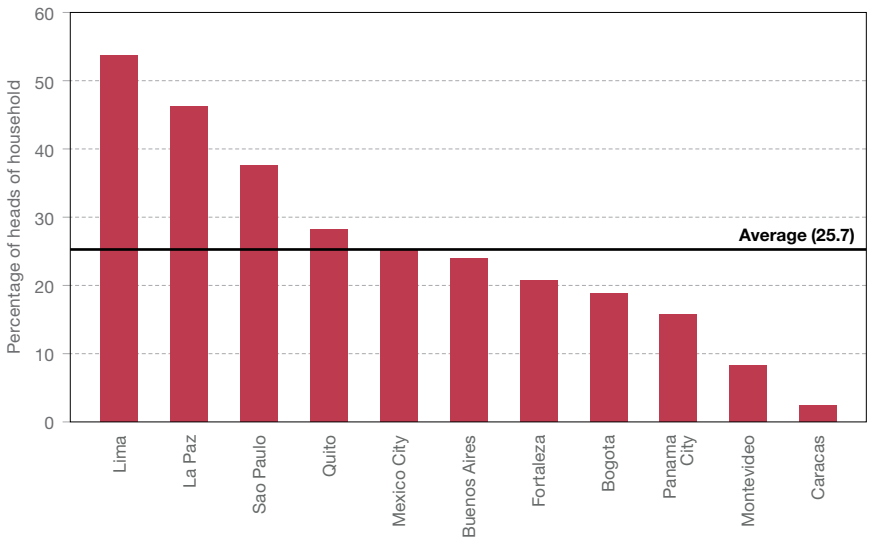
22. This difference in access to credit is similar to the difference between the upper tertile and the lower tertile of income.

26% of the head of households surveyed who are also homeowners report to have built their housing gradually.

On the other hand, income level largely determines the ability to obtain financing. According to the evidence provided by the 2016 CAF Survey, access to credit in Latin America is unequal amongst different socioeconomic levels. When enquiring with the head of those households who rent as to the reasons for not becoming homeowners, 72% reported problems with access to credit as the main reason.[23]This percentage varies, however, across the income distribution: while the percentage amongst households in the upper income tertile is 64%, it rises to 81% for lower income households.

Given the impossibility of accessing mortgage markets, low-income household and informal workers resort to alternative financing formulas. The main one is informal loans by friends or relatives. A widespread strategy, which can eventually coexist with the first one, is incremental construction: 26% of head-of-households surveyed by the 2016 CAF Survey reported that they built their housing unit gradually. However, as Graph 4.12 shows, this figure is strikingly different among cities.

Graph 4.12 Incremental housing in 11 Latin American cities [a/]



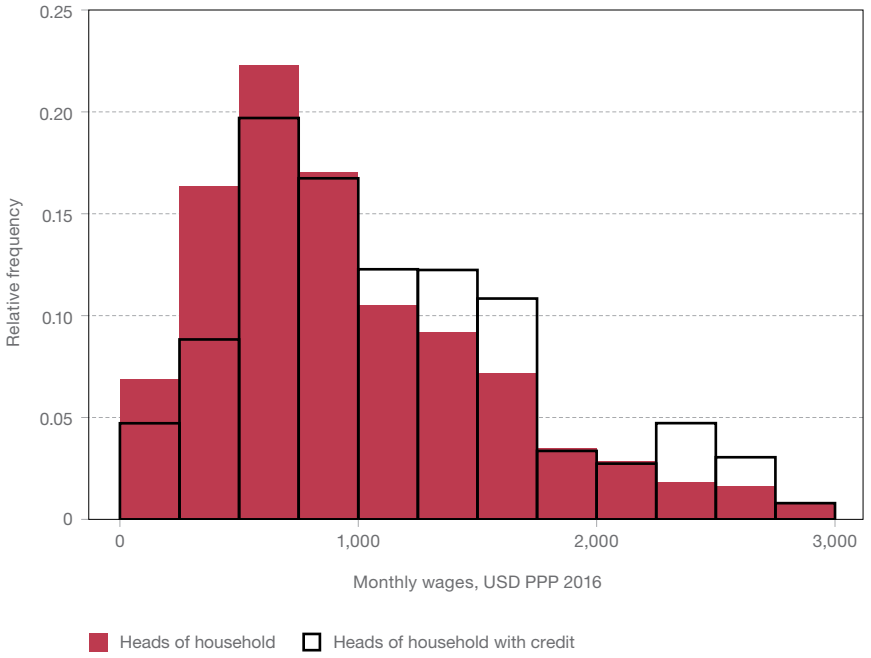
a/ The graph reports the percentage of households who answered the question "How did you come about your current house?" with "We purchased the plot and then build gradually". Only households with head-of-household respondents were considered.

Source: Authors' elaboration using data from the 2016 CAF Survey (CAF, 2016).

23. A household is considered to have problems accessing credit when the respondent states: "I am not eligible to pay a mortgage monthly" or "I do not have enough money to secure paying a mortgage monthly".

Improving the housing situation of low-income households is generally understood as introducing subsidies that benefit them. But not all subsidies are equal, since their efficacy will be determined by their design and implementation. Some instruments applied on a regular basis include the subsidy of interest rates and tax deductions for mortgage interest payments. These strategies, however, tend to disproportionately favor middle and high-income households. As mentioned earlier, this is a consequence of their higher borrowing capacity, making them more eligible to benefit from general credit subsidies. Graph 4.13 compares head of household income distribution with a subset of heads of households who have a mortgage loan, showing that the latter group has higher income. On the other hand, it is unclear to what extent these policies increase housing consumption or merely bring about a substitution among credit sources for properties that were going to be purchased anyway.

Graph 4.13 Income distribution of heads of households who have a mortgage loan vs. income distribution of all heads of households for 11 Latin American cities [a/ b/]



a/ The graph reports the histogram of heads of household's income, measured in local currency and converted into USD PPP for December 2016, at USD 250 intervals. The red bars show the income distribution of all households whose heads were interviewed. Translucent bars display the income distribution for the subset of households interviewed who are homeowners and whose head of household report to have used a mortgage loan as the main source of funding to buy their home.
b/ Data is shown for the 11 Latin American cities surveyed in the 2016 CAF Survey for formal cities and slums: Buenos Aires, La Paz, Fortaleza, San Pablo, Bogota, Quito, Mexico city, Montevideo, Panama City, Lima and Caracas.

Source: Authors' elaboration using data from the 2016 CAF Survey (CAF, 2016) and Bloomberg, downloaded on the 12th of January, 2017.

Subsidy programs should move away from general formulas applied indiscriminately to all households. A more effective design requires for subsidies to focus on households unable to afford the purchase of housing without this kind of assistance (see Text box 4.7). It is therefore necessary to define the specific problems that limit the acquisition of housing by different segments of the population (for example, restrictions on saving, employment volatility, absence of property deeds, high risk on future value of the units, etc.) and create mechanisms that allow identifying the target population of these benefits.

Text box 4.7 Subsidizing housing demand in Latin America

Several Latin American countries have implemented programs focused on low and medium-income households. However, problems in the design and implementation of these programs has limited their impact. The "ABC" programs, (Savings, Bonds and Credit, by its acronym in Spanish) have been a widespread instrument to this end. These schemes combine saving requirements by the families, a bond for the construction or acquisition of housing or land and mortgage credit to finance the rest of the investment.[a]

According to a review of existing evaluations by McTarnaghan et al. (2016), demand-based subsidy programs have succeeded in a quantitative reduction of housing deficit amongst medium-income households, but have not been effective in reaching low to very low-income households because, in these cases, they do not tackle the problem of affordability. These programs have also made it possible to reduce qualitative deficits through construction of housing with better standards (better quality units, more spacious and in some cases, although not always with better access to basic services). One of the most deficient aspects of this type of intervention, however, is usually the location of new constructions. Since planning and location decisions are often left to privates, who have incentives to locate new developments in cheap land, they often end up being located in peripheral areas, usually disconnected from the transport network and other urban infrastructure services, therefore reducing accessibility to job opportunities and increasing segregation.

a. Chile was the first country in the region to implement demand-based subsidies in the seventies. Similar strategies have been recently implemented in other countries. These include the Minha Casa Minha Vida program in Brazil, financing loans from the Instituto del Fondo Nacional de la Vivienda para los Trabajadores (Infonavit) and the Fondo de la Vivienda del Instituto de Seguridad y Servicios Sociales de Trabajadores del Estado (FOVISSSTE) in Mexico, the Vivienda de Interés Social in Colombia and the Techo Propio Adquisición de Vivienda Nueva in Peru.

Subsidizing rent demand

Another tool aimed at medium- to low- income households is rent subsidy. This alternative is widespread in the United States, materializing through voucher handouts delivered to households for rental fees.

One of the advantages of this policy is that it offers households flexibility to choose their neighborhood. If these policies are designed correctly,

The systemic solution to slums requires increasing the income-generating capacity of households and reducing the cost of accessing the formal housing market.

they can contribute to reducing socioeconomic segregation. Specialized literature has recently demonstrated that these programs can promote social mobility, since they generate important long-term benefits for the children whose families relocate to neighborhoods with lower poverty levels. It is worth noting that the effects are clearer and stronger when children leave neighborhoods with high poverty levels at an early age (Chetty et al., 2016).

In order to maximize impact, rent subsidies should be considered as complementary to deregulation of the rental sector. As pointed out above, before designing any form of demand subsidy (either for purchase or for rent), policy-making needs to focus on freeing housing supply. In the context of inelastic supply, demand subsidies will simply translate into higher prices. Rent subsidies particularly, could be captured by landlords, leading to undesirable distributive effects. In other words, the promotion of a more dynamic supply and the implementation of demand subsidies should not be understood as substitute policies.

Policies targeted at slums

Big slums concentrate the largest infrastructure deficiencies in the region. Improving the living conditions of their inhabitants is therefore the most pressing and complicated challenge faced by local governments. Great efforts have been expended towards achieving this goal, such as neighborhood improvement programs and housing regularization campaigns. It is not advisable, however, to consider this type of interventions as a solution to the general problem of slum proliferation. By raising expectations in the population (of improvement in physical capital or regularizing tenure) these programs can in fact encourage the proliferation of new slums. The systemic solution to this phenomenon therefore requires two complementary strategies: (i) increasing the income-generating capacity of households and (ii) reducing the cost of accessing the formal housing market.

This is not to say that slum interventions cannot play an important role. If they are applied in a complementary way to structural reforms, they can be interpreted as valuable transfer of resources to the families living in these neighborhoods, and a useful way of minimizing the cost of a transition to the formal sector, which can take time.

The merits of these specific slum interventions are discussed below. To this end, they are classified into three groups: in situ improvement, tenure regularization and household relocation.[24]

24. For a review of slum upgrading interventions, see Jaitman (2015).

In situ improvement programs

Improving the housing of low-income households increases the perception of wellbeing of its dwellers, but it is not enough to improve their future living conditions.

On-site home and infrastructure upgrading programs promote localized investments in the physical capital of houses and neighborhoods. Specific experiences show positive results. Galiani et al. (2014) analyzed the scope of the TECHO program (which improves the quality of housing for low-income households by delivering prefabricated units with high-quality construction materials) in El Salvador, Mexico and Uruguay, and found that the program is responsible for an increase in the satisfaction level and wellbeing reported by the recipient households, although it does not appear to have a significant impact on income and health conditions. Neither was there a visible impact on families' investment in connection to basic services, acquisition of assets or performance in the labor market. Cattaneo et al. (2009), however, show how the Mexican program Piso Firme (which replaces dirt floors with cement floors) significantly diminishes the incidence of parasitic infections, diarrhea and anemia, as well as favoring the cognitive development of the children living in the improved housing.

Although more research is needed to draw more definitive conclusions, these results suggest that while improving the housing characteristics of low-income households can potentially increase satisfaction and perceived wellbeing of the beneficiaries, it remains unclear whether these improvements provide a solid foundation for families to improve their future living conditions.

Other programs focus on expanding public service infrastructure. These investments can have positive effects on the value of adjacent properties and thus affect the consumption and investment patterns of households. This is coherent with the findings of González-Navarro and Quintana-Domeque (2016) in Mexico, where a paving program resulted in increased wealth for surrounding households, as seen by an increase in consumption of vehicles and house appliances, as well as investment in home improvement. The same type of externalities is visible when the original investment is made on the housing units themselves. Based on data from residential renovation programs in urban neighborhoods of Richmond, United States, Rossi-Hansberg et al. (2010) show that, in addition to increasing the market value of the blocks or neighborhoods in the renovated areas, these interventions additionally boosted the market value of surrounding areas. This highlights the importance of ownership structure in the neighborhoods targeted for intervention, since these structures determine who benefits and who does not, thus determining the distributive effects of the program.

The interventions reviewed so far are characterized by focusing on a specific determinant of the living conditions of low-income households. Alternatively, there are programs that promote a comprehensive approach, encompassing both components of house improvement and the provision of basic infrastructure and other urban services. The Mexican program Hábitat is one such case, providing infrastructure and scaled urban equipment to neighborhoods. In addition to supplying public services (tap water, sewer

Comprehensive interventions improve urban infastructure and the provision of basic services, but do not necessarily impact the quality of life of target families.

system, pubic lighting, road infrastructure, waste collection and treatment amongst others) and urban equipment (community centers, sports facilities, and parks), the strategy was complemented with job training and health care workshops. The evaluation carried out by Ordóñez-Barba et al. (2013), shows an impact of the program on a set of variables that were the subject of the intervention (such as habitability conditions and construction quality of housing) and moderate impact on other dimensions (such as access to services), with significant penetration in the most deprived neighborhoods, as well as positive effects in households' satisfaction level. In contrast, the program failed to impact households' living conditions, such as health conditions, public safety or access to amenities. On the other hand, Favela Bairro a similar program in Rio de Janeiro, succeeded in improving some indicators of quality of life. Research by Soares and Soares (2005) shows the program to have positively impacted access to tap water, waste collection and access to sewer system, but had no impact on health conditions, rate of victimization, property values and beneficiaries' income level[25]. In short, these evaluations suggest that while these comprehensive interventions often affect positively certain characteristics in urban infrastructure and services, these changes do not necessarily translate into substantial improvements in the target families' quality of life.

Ownership regularization

As already noted in this chapter, one of the traditional criteria for assessing the existence of a housing deficit is the security of housing tenure. In addition to the harmful effects of living in a house under the constant threat of eviction, it has been argued that irregularity in ownership slows down economic development through at least two channels. First, it reduces the incentives to invest in housing by both the owners and the State. This is because public investment in infrastructure is often contingent upon ownership regularization, which results in households being condemned to poor living conditions.[26] Second, it prevents households from accessing credit markets (due to the impossibility of using property as collateral to obtain credit), which forces them to stay on a path of low-income and low-consumption. This thesis, originally proposed by De Soto (2000), argues that a policy that grants titles to those who live in informal conditions would allow them to access credit and encourage them to make long-term investments in their housing, which would leverage their economic progress and improve their living conditions.

What does the evidence say? Studies of the effects of ownership regularization on access to the formal credit market have not found the expected impacts (Field, 2005; Galiani and Schargrodsky, 2010). But they have determined

25. A program carried out in Medellin, Programa Urbano, is another example of comprehensive improvement of life conditions in segregated urban areas. So far, this initiative has not been rigorously evaluated.

26. One example is the Hábitat program in Mexico. Since the changes introduced in 2009, one of the requirements imposed on the neighborhoods in order to be beneficiaries of the program was to not be in an irregular land tenure situation (Ordóñez-Barba et al., 2013).

that the securitization of housing increases residential investment. Galiani and Schargrodsky (2010), who analyzed the effects of a title regularization program in slums in Buenos Aires, found that beneficiary households are more likely to expand the built-up areas and improve the quality of their homes. Meanwhile, Field (2005) evaluated the effects of a nationwide tenure regularization program in Peru and noted that granting titles significantly increases investment in housing renovation.

One important finding is that granting of titles favors the labor force participation of the beneficiaries. This is because, in the absence of guarantees on home ownership, people must stay in the house to avoid unexpected evictions (Field, 2007). Ownership regularization also promotes a reduction in household size (due to both a reduced presence of extended family members in the household and a reduction in the birth rate of households) and fosters increases in education levels among youth (Galiani and Schargrodsky, 2010). Another interesting result is that titles can redistribute power to the interior of the household. Field (2003), for example, finds that when women are given ownership rights, their bargaining power increases, which translates into fewer births (one of the channels that explains the relationship between ownership rights and household size).

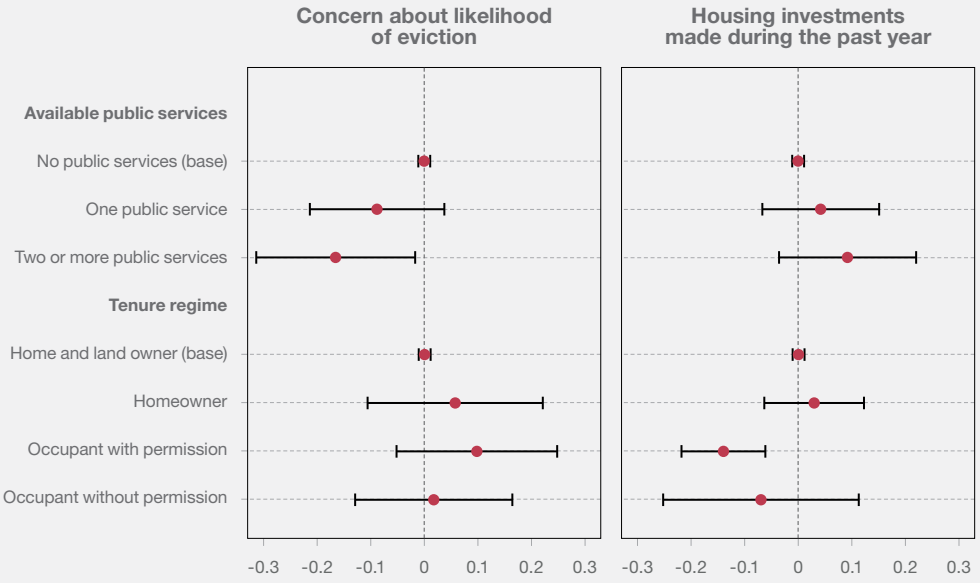
Text box 4.8 Ownership system, fear of eviction and investments in housing

The feeling that at any moment one could be the victim of an eviction is a factor that undermines a household's living conditions. In addition to the psychological effects that could result, the insecurity inherent to not having the right to live in a home can affect investment and housing improvement decisions as well as decisions regarding employment outside the household (Galiani and Schargrodsky, 2010; Field, 2007).

Two factors that could influence the likelihood of eviction are the lack of a formal property title for the unit and the lack of public service infrastructure. The first point is simple: it is to be expected that the lack of a property title would be directly associated with concern about likelihood of eviction. In the second case, public service infrastructure could reduce fear of possible eviction, because it could be interpreted as the State's de facto acceptance of informal occupation.

In this sense, Graph 1 shows how tenure and availability of public service infrastructure are related to the concern over possible eviction and the decision to invest in housing based on a sample of households located in slums in Buenos Aires, Fortaleza, Bogota and Caracas. It can be observed that access to one or more basic public services (such as drinking water, electricity or sewage system) is associated with less concern over possible eviction and with a greater probability of having renovated the home, as compared to a household that does not have access to any services. Similarly, owning only the housing (but not the land) or being an occupant (with or without permission) is associated with increased concern about possible eviction and reduced investment in renovations, relative to a household that owns both the housing and land.[a]

Graph 1 Concern about the possibility of eviction and housing investments by access to public services and declared tenure regime for several Latin American slums [a/ b/]



a/ The graph shows the coefficients and 90% confidence intervals, estimated by ordinary least squares, of the association between the concern about the possibility of eviction (left panel) and the implementation of housing reforms during the year prior to the survey (right panel), and indicators of access to public services (tap water, electricity, sewage) and reported tenure regime, controlling for socioeconomic characteristics of the respondent (gender, age, education level, time of residence in the neighborhood) and city of residence.
b/ The sample is restricted to heads of household that live in slums located in Buenos Aires, Fortaleza, Bogota and Caracas.

Source: Authors' elaboration using data from the 2016 CAF Survey (CAF, 2016).

a. In the case of occupants without permission, the coefficients are not statistically significant. This lack of precision may be due to few people reporting this condition when surveyed about their tenure situation.

However, granting property titles may be insufficient if the costs for households to remain formalized are too high. Galiani and Schargrodsky (2016) observed that, between 12 and 21 years later, 29% of the properties regularized in the aforementioned program were irregular once again. This is because property transactions, such as the sale of property and transfers of ownership due to divorce or succession, for example, generate costs that may be too high for the owners, especially considering the low value of the properties.

In short, taken as a whole, these policy decisions generally show positive effects of ownership regularization, especially in terms of a greater propensity to invest in housing and work outside the home, but not so much in terms of greater access to credit. Accompanying this type of initiative with others that reduce the costs of remaining formalized could help sustain these benefits over time.

Relocation of households

An alternative way of approaching the problem of housing shortage in slums is to facilitate access to new low-cost housing, which is typically located in other zones. The rationale for this approach is that some of these slums are in such an advanced and complex state of instability that it is better to offer their inhabitants the opportunity to start from scratch elsewhere. To the extent that the new developments receiving these households meet certain quality standards, traditional housing indicators will improve. In spite of this, the evidence suggests that in most cases moving does not translate into higher income and is accompanied by other problems such as the disintegration of previously established social networks (Jaitman, 2015).

The fundamental flaw of these policy decisions is that they ignore the value that households place on living in certain locations. For this reason, these programs tend to have low acceptance rates, which worsen over time, and often leave behind a legacy of abandoned buildings of no economic value. Thus, it is worth emphasizing once again the importance of location as an attribute of housing. Barnhardt et al. (2017) study the case of a lottery in Ahmedabad, India that allowed the winners to move from slums where they lived to better-quality housing on the outskirts of the city (with more than 50% of monthly rent subsidized). Fourteen years after the lottery, the winners did indeed live in better-quality housing, but they had not experienced changes in household income or improvements in human capital. In addition, winners reported higher levels of isolation from friend networks and family, and less access to informal insurance mechanisms. Perhaps even more significantly, 34% of the winners never moved to the houses they were awarded, and an additional 32% abandoned them to return to a location near the city center. Based on the analysis of a similar lottery in Rosario, Argentina, Alzúa et al. (2016) show that among the winning households (who were also given a house in a suburban neighborhood) the (formal) employment rate fell by 7 percentage points, mainly due to the lack of employment opportunities in the suburbs.

As mentioned above, housing policy should be especially cautious when it comes to financing developments in areas that have no economic value, since this lack of value is often a consequence of a major lack of access to the city's benefits, which include amenities and employment opportunities.

Conclusions

Latin American housing markets have not properly responded to the region's rapid urbanization process because they suffer from several problems that limit the ability of cities to take full advantage of potential agglomeration economies. There are various bottlenecks. To begin with, real estate inventory has major deficits in terms of the quality of the units. Oftentimes these deficits are associated with failures in access to basic services, which can have negative

consequences on the physical and cognitive development of individuals and on their well-being. At the same time, housing prices are high relative to incomes, and this problem of low affordability is aggravated by the lack of depth of the mortgage markets. Finally, the region is characterized by a marked duality between the formal and informal housing sectors. The first is primarily for high-income families, and the second provides more economical but deficient solutions for a large fraction of the population.

The first step that needs to be taken to define housing policy is to recognize that the deficiencies observed in this area are consequences of two simultaneous factors: low income levels that limit household consumption capacity and inefficiencies in real estate supply that slow down and raise the prices of creating units. In this context, a systemic housing policy, which seeks to improve access to quality housing for all, must start by unlocking supply in this market. This means streamlining regulatory frameworks on land use and building codes, modernizing bureaucratic processes associated with building permits and land registries, and fostering professionalism and competition in the construction industry, among other measures. With regard to regulations on land use and residential construction, there are some that must be analyzed to determine if they are appropriate. However, in order to assess this suitability, it is imperative to systematize information on the regulations in force in the municipalities of the region, thus enabling the effects of specific regulations to be identified.

The second task that housing policy must face is to stimulate the expansion of mortgage markets. Without sources of funding, access to housing is severely limited, especially for low- and middle-income households. This, in turn, feeds the supply problems (because developers have no incentive to build units for which there will be little demand) and encourages households to search for informal solutions.

In addition to ensuring an ample mortgage market, policies that seek to increase demand for housing should always be thought of as complementary to initiatives aimed at expanding the supply of units. In fact, general subsidies for housing purchases should be avoided. Instead, it is critical to identify specific bottlenecks that limit access to housing for certain segments of society (e.g., lack of savings or labor informality) and apply correctives in a selective and targeted manner.

On the other hand, the rental sector, traditionally relegated to the background in the region, can also play an important role in facilitating access to quality housing. Thus, it is necessary to streamline rent regulations, promote a legal framework that covers tenants and owners equally, and avoid price controls. These measures could increase the supply of rentals in two ways: by the entry into the market of unoccupied units and by encouraging the construction of new rental projects.

This chapter also focuses on the phenomenon of slums. It provides a characterization of these spaces and the households that inhabit them,

supported by new quantitative and qualitative evidence expressly gathered for this project. Data and testimonies reflect clear differences in living conditions between these informal settlements and formal neighborhoods in Latin American cities. Closing these gaps should be a priority of public policy, although unfortunately there is currently no clear formula for achieving this goal.

Nonetheless, it should be noted that there is a close relationship between the weak performance of the formal housing market and the incidence of slums, and this is one of the messages highlighted by this chapter. To reduce the number of households that live in slums, it is necessary to increase the income-generating capacity of their inhabitants and to reduce the relative price of living in the formal city. As indicated above, to achieve this, efforts must be directed towards expanding formal housing supply and developing sources of financing.

As for on-site improvement programs, they can be useful in transferring necessary resources to the current inhabitants of slums, but should not be seen as a definitive solution to the slums' existence. According to the specialized literature, localized investment can generate local improvements, but without structural corrections it is impossible to reduce the overall incidence of slums in a city.

Meanwhile, social housing programs that seek to relocate households in new developments have the disadvantage of being typically located in peripheral areas with little economic appeal, due to the limited access they provide to employment opportunities and city amenities. Instead of prioritizing the construction of low-value housing, the State should choose to invest in community facilities and road infrastructure, and in services that revalue land with little connectivity and make residential investments profitable.

Appendix

Rental and housing prices (Graphs 4.3 and 4.8)

Housing and rental prices that were reported in U.S. dollars were converted into local currency using the Bloomberg exchange rates for January 31, 2017. For Chile, the values expressed in unidades de fomento (inflation index units) were converted to Chilean pesos according to data from the Central Bank of Chile.

Due to the fact that the information on labor earnings and housing prices (both sales and rental) correspond to different periods, the prices of homes were deflated to June values of the year corresponding to the earnings data. Deflators were calculated from the following sources:

Bogota: Consumer Price Index for the city of Bogota D.C., "Housing" category, National Administrative Department of Statistics.

Buenos Aires: Consumer Price Index of the City of Buenos Aires, "Housing, water, electricity and other fuels" category, Directorate General of Statistics and Censuses, Ministry of Finance of the Government of the City of Buenos Aires.

Santiago de Chile: Consumer Price Index for the Greater Santiago area, "Housing and basic services" category, National Institute of Statistics.

Lima: Consumer Price Index for the Lima Department, "Housing rental, fuels and electricity" category, National Institute of Statistics and Informatics, Technical Directorate of Economic Indicators.

Mexico City: National Consumer Price Index for the Metropolitan Area of Mexico City, "Housing" category, National Institute of Statistics and Geography.

Montevideo: Consumer Price Index for the city of Montevideo, "Housing" category, National Institute of Statistics.

Quito: Consumer Price Index for the city of Quito, "Accommodation, water, electricity, gas and other fuels" category, National Institute of Statistics and Censuses.

The labor earnings data come from household surveys of the Socio-Economic Database for Latin America and the Caribbean, CEDLAS and the World Bank: Bogota D.C. (2014), Greater Buenos Aires (2015), Greater Santiago (2015), Metropolitan Area of Lima (2015), Montevideo (2015), Quito (2014), and the Metropolitan Zone of the Valley of Mexico (2014).

Mortgage debt (Graph 4.10)

The data come from the Housing Financial Information Network (HOFINET). The last published value for each country is always used. Therefore, regional averages were shaped as follows:

Latin America includes Argentina (2014), Bolivia (2013), Brazil (2013), Chile (2014), Colombia (2015), Costa Rica (2015), the Dominican Republic (2015), Ecuador (2013), El Salvador (2012), Guatemala (2013), Honduras (2013), Mexico (2014), Nicaragua (2013), Panama (2013), Peru (2015), Uruguay (2010) and Venezuela (2013).

Africa includes Argelia (2012), Botswana (2015), Burundi (2013), Cameroon (2011), Cape Verde (2013), Egypt (2013), Ethiopia (2014), Ghana (2013), Kenya (2013), Liberia (2008), Malawi -(2014), Morocco (2015), Mozambique (2014), Namibia (2011), Nigeria (2011), Rwanda (2013), Senegal (2010), South Africa (2015), Tanzania (2015), Tunisia (2013), Uganda (2014), Zambia (2012) and Zimbabwe (2012).

Asia includes Azerbaijan (2015), Bahrain (2012), Bangladesh (2015), Bhutan (2015), China (2015), Georgia (2015), Hong Kong (2015), India (2013), Indonesia (2015), Iran (2011), Israel (2015), Japan (2015), Jordan (2015), Kazakhstan (2015), Kuwait (2015), Lebanon (2013), Malaysia (2015), Mongolia (2015), Nepal (2013), Pakistan (2015), Saudi Arabia (2014), Singapore (2015), South Korea (2015), Sri Lanka (2014), Thailand (2015), Taiwan (2015), the United Arab Emirates (2013), Uzbekistan 2010) and Vietnam (2014).

Europe includes Albania (2015), Armenia (2015), Austria (2015), Belgium (2015), Belarus (2015), Bosnia and Herzegovina (2015), Bulgaria (2015), Cyprus (2015), Croatia (2015), the Czech Republic (2015), Denmark (2015), Estonia (2015), Finland (2015), France (2015), Germany (2015), Greece (2015), Hungary (2015), Ireland (2015), Iceland (2015), Italy (2015), Latvia (2015), Lithuania (2015), Luxembourg (2015), the Netherlands (2015), Norway (2014), Poland (2015), Portugal (2015), Romania (2015), Serbia (2015), Slovakia (2015), Slovenia (2015), Spain (2015), Sweden (2015), Switzerland (2015), Turkey (2015), the United Kingdom (2015), and the Ukraine (2015).

TOWARDS AN IMPROVED METROPOLITAN GOVERNANCE

Chapter 5

Chapter 5
TOWARDS AN IMPROVED METROPOLITAN GOVERNANCE [1]

Introduction

Previous chapters have shown that despite the relatively high population density that characterizes Latin American cities, most of them do not present a positive balance when comparing the benefits of agglomeration economies and the costs associated with the externalities of congestion. As a result, its inhabitants face a relatively low accessibility to jobs, services and amenities. This is due, amongst other reasons, to suboptimal regulations on land use (Chapter 2); limited transportation infrastructure, especially public transportation (Chapter 3), and the limited supply of affordable housing (Chapter 4). From a technical viewpoint, several of the public policy proposals discussed in previous chapters have the potential to lead cities in the region to a new equilibrium, in which the advantages of agglomeration prevail, so that more productive cities, with more accessibility and, therefore, greater levels of wellbeing for their inhabitants may emerge. Nevertheless, beyond their technicaladvantages, these policies alone do not guarantee success, as their effectiveness largely depends on metropolitan governance.

This chapter analyzes the role of metropolitan governance in providing solutions to several of the problems affecting Latin American cities. In particular, the organizational and institutional aspects of the implementation and coordination of public policies at the metropolitan level are discussed, since the formulation of urban development policies in the region and their effective implementation require suitable institutional arrangements. In this sense, a critical component is that such metropolitan governance initiatives should promote transparency, accountability, and citizen participation in order to strengthen their legitimacy.

Governance is understood as the process of decision-making and policy implementation in which different levels of governmen and public institutions, as well as private and civil sectors, usually interact. In addition to formal institutions, governance also includes interactions and informal arrangements that may exist between different actors.

The importance of metropolitan governance arises from the fact that the administrative definition of the metropolitan area, and its subsequent political organization, rarely coincides with its size and its economic and social functioning. Due to a lack of coordination, this difference leads to inefficiencies due to problems of scale and externalities. For example, when municipalities in the metropolitan area do not coordinate transport,

1. This chapter was written by Christian Daude, with research assistance from Roberto Ferrer, Federico Juncosa and Cynthia Marchioni.

Metropolitan governance is an instrument for solving coordination problems.

passengers suffer higher transportation costs and longer transfer times because the efficient scale of provision for this service usually exceeds that of the local government. Likewise, the decisions of a municipality often cause externalities for the other members of the metropolitan area. For example, land use regulations, such as limitations on the type of residential construction or restrictions on commercial land use in a municipality, can push low-income inhabitants to the informal periphery of cities as a result of the increase in the cost of housing, as well as causing urban sprawl that leads to greater use of private and collective transport. In terms of congestion and pollution, this creates negative externalities for the city as a whole.

How can metropolitan governance provide effective responses to these types of problems while at the same time foster citizen participation and the legitimacy of public action in these urban areas? This hapter attempts to answer this question. To this end, the following pages briefly present the economic and political foundations that justify the existence of different institutional arrangements to govern the metropolitan area, as well as presenting different views on the need to foster coordination mechanisms between government organizations. Modes of metropolitan governance are described afterward, exploring some of their advantages and disadvantages in greater depth. This is followed by an outline of the most important characteristics of governance in metropolitan areas of Latin America. Finally, some of the necessary conditions to achieve successful governance reforms to improve the effectiveness of metropolitan public policies, especially regarding land use, transport, and housing regulations are discussed.

Why does metropolitan governance matter?

Coordination failures that affect the implementation of urban development policies and the provision of goods and services generate inefficiencies in terms of what is socially desirable, either due to problems of scale or the existence of externalities. In this sense, metropolitan governance, from an economic standpoint, is an instrument to solve the challenges of coordination. On one hand, the municipalities that make up a metropolitan area may not have the capacity to provide some services efficiently (such as collection and treatment of waste), and associating with other municipalities to provide them together would reduce their costs. On the other hand, the actions of a municipality or a sectorial agency with territorial coverage can cause negative externalities for other members of the metropolitan area, or on policies in other sectors. For example, a municipality could redefine land use regulations by favoring residential and business use without considering urban transport infrastructure planning, possibly causing negative effects on travel times not only within its territory, but also in neighboring municipalities. Likewise, inadequate

land use regulation could prevent the distribution of certain basic services such as water and sewage for a metropolitan area (see Text box 5.1). It is for this reason that a lack of coordination not only generates inefficiencies, but can also have important negative consequences on the quality of life of a city's inhabitants.

Text box 5.1 Land use regulation and provision of services in informal settlements in Bogota

Botero et al. (2017) study in depth the case of the Eden and Potosi slums in Ciudad Bolivar (part of the Metropolitan Area of Bogota), and show the effects of a lack of effective coordination on land use regulation with regards to the provision of public water and sewage services.

In El Eden, which is classified as a rural area within the land use plan (Plan de Ordenamiento Territorial) in spite of being densely populated, the current regulation does not allow residential use of land or the installation of public services. However, an alternative procedure was used for the provision of water that allows charging a fee to temporarily supply water from aqueducts to irregular users and install drinking water networks in the neighborhood. For the sewage service, however, there are coordination problems that prevent installing networks. Therefore, the neighborhood has a poorly improvised sewage system, unconnected to the formal network of neighborhoods and that generates serious environmental problems and issues of soil stability. Potosi on its part is a member of an urban zonal planning unit that, as a legal organization, has already gained formal access to drinking water and sewage networks.

In the absence of coordination mechanisms and institutions at a metropolitan level, the administrative fragmentation of the city (determined not only by the existence of several municipalities, but also by the actions of state or provincial authorities and even national authorities) implies the lack of a long-term strategic vision for urban development that is able to combine, for example, land use as well as transport and housing policies. One example is the case of the Metropolitan Area of Buenos Aires, where designing an effective metropolitan transport policy was hampered by disagreements amongst different levels of government (see Text box 5.2, p. 234).

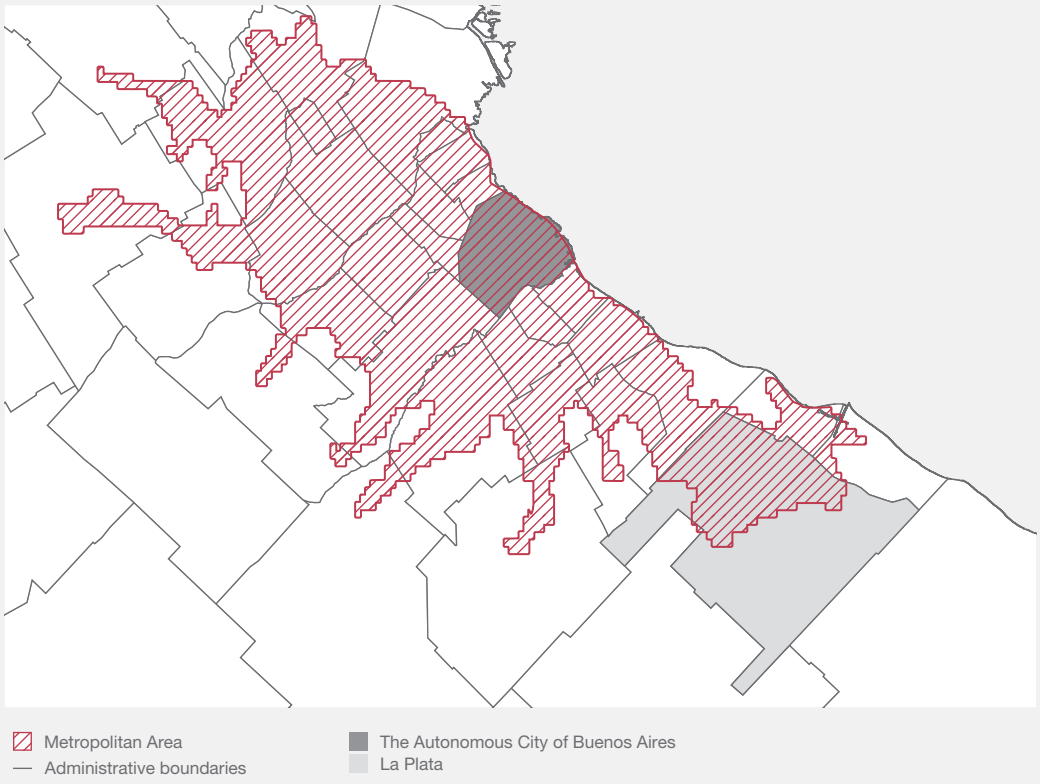
More generally, the empirical evidence for OECD countries shows that a high fragmentation of metropolitan governance is correlated with lower levels of productivity and lower rates of economic growth (Ahrend et al., 2017). In addition, the existence of formal government metropolitan institutions for this group of countries is linked to greater citizen satisfaction in areas such as public transport and environmental quality (Ahrend et al., 2014, 2017). There is also evidence in the United States that greater municipal fragmentation leads to higher levels of social segregation that, when

measured in terms of health, employment and education, also negatively affects the wellbeing of the most vulnerable populations (Cutler and Glaeser, 1997, Kim and Bruckner, 2016).

Text box 5.2 Coordination of public transport policies in the Metropolitan Area of Buenos Aires

According to data from 2010, the Metropolitan Area of Buenos Aires has more than 14 million inhabitants and covers a total of 32 municipalities in the province of Buenos Aires (called "partidos"), which include the provincial capital (La Plata) and the Autonomous City of Buenos Aires (see Graph 1). In the Metropolitan Area of Buenos Aires four levels of government converge: municipalities, the province of Buenos Aires, the City of Buenos Aires and the national government, given that being the country's capital, the national government also plays an important role in the governance of the metropolitan area. Thus, in the absence of policy coordination mechanisms, the provision of goods and services to the population is often plagued with inefficiencies.

Graph 1 Urban sprawl of the Metropolitan Area of Buenos Aires and local administrative divisions in 2010



Source: Author's elaboration using data from the CAF's Database on the Extension of Metropolitan Areas (CAF, 2016) and Ch et al. (2017).

For example, the lack of a metropolitan transport authority (MTA) has been a barrier to rationalize bus routes, coordinate prices, tariffs and subsidies, and provide effective multimodal integration (World Bank, 2009). In 2012, the national government, the province of Buenos Aires and the Autonomous City of Buenos Aires signed a tripartite agreement to create the MTA, which was to act as an advisory body to coordinate and plan transportation in the Metropolitan Area of Buenos Aires. However, political differences between the different authorities (the national government and the province of Buenos Aires belonged to a different political party than the city´s authorities) rendered the MTA non-functional until the national elections in 2015 resulted in the three governments belonging to the same political party. Since then, the coordination of transport policies has been more agile, based on the use, above all, of informal mechanisms and agreements, rather than formal resolutions by the MTA. Even though the MTA has a provisional operating regulation, in early 2017, this body still lacked the human and financial resources to acquire a relevant role.

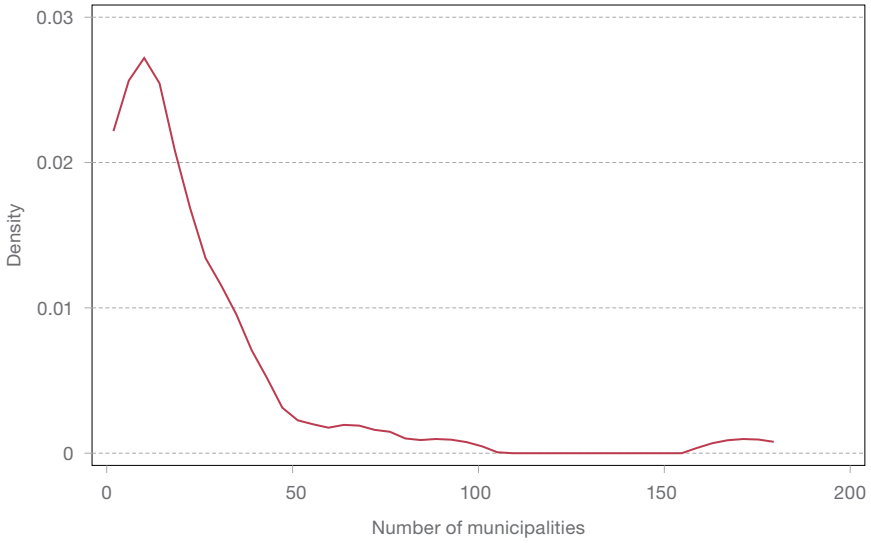
This case study emphasizes that metropolitan governance institutions are not necessarily effective in the absence of clear political legitimacy, as well as the fact that when there is a good alignment of incentives, or the necessary trust, informal institutions are often sufficient to solve coordination problems.

As shown in Graph 5.1 (see p. 236), there is a high level of administrative fragmentation in metropolitan areas in Latin America. In 2010 only 3 of the 43 cities in the region with more than 1 million inhabitants did not cover or intersect with more than one municipality (Ciudad Juarez and Tijuana in Mexico, and Maracaibo in Venezuela).[2] At the other end, metropolitan areas such as of Sao Paulo and Rio de Janeiro in Brazil, as well as Mexico City comprise a very large number of municipalities (172, 89 and 65 municipalities, respectively). In general, 50% of Latin American cities with more than 1 million inhabitants cover at least 12 municipalities. Although there is no empirical evidence regarding the effects of this fragmentation in Latin America, it would be surprising if it did not have negative effects like those found in other regions. In addition to the case study in the transport sector described earlier, there is evidence in the water sector that also points to administrative fragmentation having negative consequences on water and sanitation services in the region (see Text box 5.3, p. 236).

2. Nevertheless, Ciudad Juarez and Tijuana are unique in the sense that they are situated on the border with the United States and form binational metropolitan areas with El Paso and San Diego.

50% of Latin American cities with more than 1 million inhabitants cover at least 12 municipalities.

Graph 5.1 Distribution of the number of municipalities or local governments in Latin American metropolitan areas with more than 1 million inhabitants [a/]



a/ The graph shows an estimation of the density of the number of municipalities that make up metropolitan areas, using a nonparametric method.

Source: Author's elaboration using data from the CAF's Database on the Extension of Metropolitan Areas (CAF, 2016) and Ch et al. (2017).

Text box 5.3 Differences in the governance of water and sanitation policies

The case of water and sanitation policies in cities is a clear example of how governance structures between levels of government, as well as between different sectorial policies, influence the coverage and quality of the service that is provided. In this sense, it is notable that even though higher levels of coverage at a national level are associated with greater service satisfaction, there are large variations in terms of satisfaction among Latin American countries with similar levels of coverage. One explanation for this phenomenon is that, in part due to management problems, service quality and continuity are often poor. In this case, coordination failures between different levels of government are generated because fragmentation in the city's administration gives rise to a decoupling between formal institutional management spaces and the hydrographic reach of water resources. In addition, water and sanitation policy is closely related to land use, solid waste management, urban transport and planning policies, resulting in horizontal and vertical policy coordination problems. In fact, although water-related crises (such as floods) are often associated with lack of infrastructure, lack of funding or water problems, they do in fact reflect the failure of governance in providing adequate responses to existing risks (OECD, 2016).

An OECD study in 13 of the region´s countries identifies a number of gaps in water policy governance and highlights the importance of the following seven dimensions: (i) gaps in administration arising from differences between the city's administrative division and the hydrological area; (ii) gaps in policy reflecting sectorial fragmentation between different ministries and agencies; (iii) gaps in objectives between institutions with different aims that create barriers to more effective collaboration; (iv) gaps in capacity that occur mainly at a local level; (v) gaps in financing; vi) gaps in information shared between the parties involved; and (vii) gaps in transparency (Akhmouch, 2012). The first three relate primarily to aspects of coordination, the next two relate to capacity constraints and financing, and the latter two reflect mainly aspects associated with the transparency and legitimacy of institutional arrangements.

Although many of these gaps coexist in most Latin American cities, the main problems are due to a lack of coordination, such as the overlapping of responsibilities and functions amongst different agencies, and the difficulty in assigning responsibilities that result in reduced transparency and the involvement of all relevant actors in the processes of consultation and definition of policies. For example, while ensuring the participation of relevant actors is considered a very important challenge in 7 of the 13 Latin American countries studied, only one of the 16 OECD countries for which the same information is available reports the same degree of difficulty (Akhmouch, 2012).

It should be noted that there is an alternative view on metropolitan governance, in which municipal fragmentation and the absence of a supra-municipal institutional structure can produce benefits for citizens. In theory, this would occur as a result of competition between localities to attract people and firms to settle within their administrative boundaries, leading to better public goods and services and more attractive taxation (Tiebout, 1956). This view is based on the principle of subsidiarity, which states that service provision should occur at the level of government closest to citizens, resulting in efficiency gains, particularly if citizens differ in their preferences for goods and services, and how to finance them. According to this view, municipal fragmentation would also generate political legitimacy gains, since citizen participation (in consultations and in accountability) is easier at a local level (Barnett, 1997).[3]

3. A solution to the potential problems of fragmentation, for those who share this perspective, is the absorption or union of municipalities in order to match, as far as possible, the administrative boundaries of municipal government with the functional metropolitan area (Carr and Feiock, 2004).

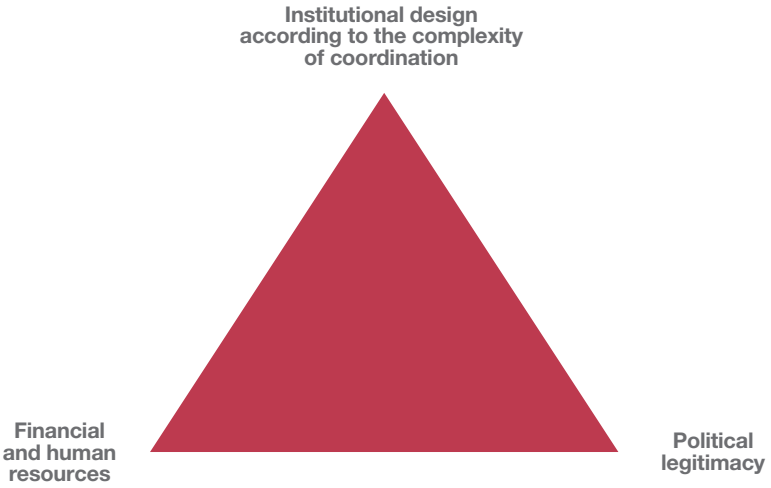
There is no ideal governance model, but there are three key factors coordination complexity, political legitimacy, and financial and human resources.

Main defining factors that condition metropolitan governance arrangements

There is no ideal universal governance model, as the most suitable type of governance for each city depends on several context-specific elements. First, it is important to consider the complexity of policy coordination challenges faced by the metropolitan area (see Graph 5.2). For example, solid waste collection does not generate major coordination challenges between municipalities, so it is common for municipal administrations to sign relatively flexible agreements or contracts with each other to provide this service. In contrast, major transport infrastructure works or the design of territorial development plans in the metropolitan area, usually involve the coordination of local land use regulations. In this case, due to the complexity of required coordination processes, the externalities involved and the potential conflicts of interest that may be generated, it would be very helpful to establish a formal metropolitan governance structure.

The second crucial element in defining the most viable and sustainable type of governance is political legitimacy (see Graph 5.2). Administrative structures and institutions that concentrate power at the metropolitan area level, or are directly elected but are not accountable, tend to have weak ties with the population and, therefore, tend to weaken over time, especially when put to the test. An example of the problems that arise in these situations is the citizen's great inconformity with the implementation of the Transantiago bus rapid transit system (BRT) in Santiago de Chile (see Text box 5.4).

Graph 5.2 Factors that condition the type of metropolitan governance



Source: Author's elaboration.

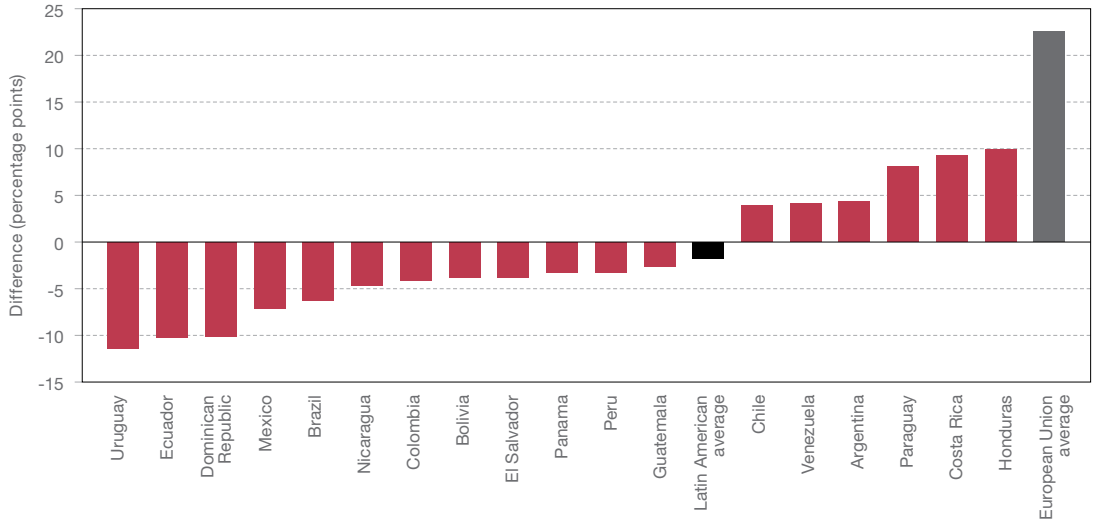
Text box 5.4 Governance issues in the implementation of Transantiago

The difficult implementation of Transantiago, in Santiago, Chile, is a good example of governance or institutional design problems in urban transport. The governance structure created for Transantiago was a contributing factor to the problems that emerged when it became operational in 2005. In particular, Briones (2009) highlights the high discretion exercised by the national government in the decision making process (neither the Legislative Power nor the metropolitan government exercised any control) as one of the main institutional factors that resulted in the new system being inadequately designed. The lack of a prior consultation process with citizens who would be directly affected created a scenario with a minimum of available information and a population with little knowledge about the reasons for which certain decisions were made. As a consequence, and due to general inconformity with the system, ticket evasion rates reported by the Chilean Ministry of Transport and Telecommunications are at 28%, a very high figure compared to those observed in Australian or European cities, or in Bogota's Transmilenio system (Tirachini and Quiroz, 2016).

In Latin America, two reasons worsen the legitimacy problem. On one hand, the rapid growth of many cities in the region means that, in general, the expansion of the metropolitan area is not accompanied by a similar rate of change in terms of citizen´s sense of belonging. This is especially the case in slums, where poor coverage of basic public services is often associated with a lack of concern by municipal and governmental authorities. As mentioned in Chapter 4, coverage shortfalls are compounded by the fact that in slums the quality and continuity of services tend to be worse than in the formal city. On the other hand, the strong spatial and economic segregation that occurs in most cities means that many inhabitants identify more with their municipality or their neighborhood than with the city itself, since there are few common spaces shared with inhabitants from other neighborhoods. This may reduce the willingness to finance public goods that benefit most parts of the territory and, in general, may weaken the financing of the metropolitan area. According to this logic, the creation of a possible vicious circle between insufficient legitimacy to respond to the negative externalities created by urban expansion and a chronic lack of financial resources, constitutes a threat to the proper functioning of metropolitan areas.

In this sense, if one compares citizen trust in local governments with that of national governments, it can be noted that in most countries in the region there is lower trust in the former. This contrasts with what occurs in developed countries, where trust in local governments is generally greater than trust in the national government (see Graph 5.3, page 240). Thus, many Latin American metropolitan areas seem to be trapped in a bad equilibrium in which, on one hand, they do not have the governance structures, tools and resources needed to give effective responses to the problems faced by their inhabitants and, on the other, they do not possess the legitimacy and citizen trust that would allow the creation of a political base to alter these restrictions.

Graph 5.3 Difference between trust in local/subnational governments and in national government in 2013 [a/ b/ c/]



a/ The vertical axis shows the difference between trust in the local government and the national government. Negative values imply greater trust in the national government over the local.
b/ For Latin American countries, trust is calculated from answers that indicate a lot of trust, some trust or little trust, whereas the European Union average is based on answers that indicate that people tend to trust.
c/ The following 28 countries are taken into account for the European Union average: Austria, Belgium, Bulgaria, Cyprus, Croatia, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Spain, Sweden and the United Kingdom.

Source: Author's elaboration using data from Latinobarómetro (2013) and the European Commission (2013).

Finally, the third element that shapes different types of governance is the availability of resources, both financial and human (see Graph 5.2, p. 238). In many cases, cooperation between municipalities or sectorial agencies is facilitated by financial incentives granted by the national government. For example, in France, the central government encourages coordination between municipalities and the creation of metropolitan governments through incentives to co-finance supra-municipal territorial plans (Lefèvre, 2008). However, the financial and human resources that are needed differ significantly according to the type of governance being adopted (OECD, 2015). Certain activities, such as integrated strategic land use planning and the expansion of transport networks, require a bureaucracy that has the capacity to carry out the studies and evaluations associated with these tasks, as well as the financial muscle capable of funding the exact investments needed.

In general, more complex activities require more specialized human resources and also more financial resources. The question is, where do these resources come from? This question is especially relevant because the metropolitan level is not usually one that belongs to the traditional levels of government, which generally comprises the national, regional and local governments, as

recognized by the constitutions of Latin American countries. It is therefore common for traditional actors in the tax transfer system to see the metropolitan government as a competitor for (limited) existing resources. In fact, it is often the case that the transfer of responsibilities to the metropolitan level is not supported by enough resources. In addition, since metropolitan governments do not integrate the fiscal institutional framework, they generally do not have the right to charge taxes, so they depend on transfers from other levels of government or their capacity to recover costs through the collection of fees for the services that they provide (see Chapter 2). In conclusion, metropolitan institutions and governments often face large financing and human resource gaps (UN-Habitat, 2014).

The transfer of responsibilities to the metropolitan level is not supported by enough resources.

In the absence of a balanced relationship between these three dimensions (complexity, legitimacy and resources), metropolitan governance faces obstacles to its correct functioning. There are several examples, even in developed countries, of metropolitan institutions that have been ineffective, and on many occasions, have been abolished for lack of political legitimacy. For example, in 1963 the Greater London Council (GLC) was created, which included the city of London and 32 surrounding local districts. The GLC had great legitimacy, since it covered the functional area of the city relatively well and had its own tax resources, as well as sufficient human resources (it had close to 10,000 employees). However, although GLC members were directly elected, there were conflicts of interest that overlapped with transport and urban planning policies of local governments. In 1985, after a series of political disputes with the national government, the GLC was eliminated, without too much resistance from the citizens (Lefèvre, 2008). In other cases, for similar reasons, reforms that created supra-municipal governance structures were rejected. In Amsterdam and Rotterdam (the Netherlands), for example, this rejection came about by popular vote (OECD, 2015).

Modalities of metropolitan governance

The modalities of metropolitan governance can be classified according to the mechanisms used to solve coordination problems: informal versus formal/institutional. Within formal mechanisms it is possible to distinguish the institutions that are created according to whether they constitute horizontal coordination between municipalities or if they are formed at higher levels of government (either at the regional government level or by effectively establishing the metropolitan government institutions as another level of government); whether they are sectorial or multi-sectorial, and whether their authorities are directly elected. Table 5.1 shows the main modalities that exist according to this classification, as well as their relationship with the key elements considered in the previous section in relation to the complexity of coordination problems, legitimacy, transparency, citizen participation in metropolitan decision-making process and the availability of resources. This section discusses the advantages and limitations of each modality based on some examples from Latin America and the conceptual framework described above.

Informal arrangements are the most frequent form of metropolitan coordination in the world. However, there are important constraints to achieving credible medium or long-term commitments.

Informal arrangements (in which no permanent institutions are created and there are no written agreements between the parties) are the most frequent form of metropolitan coordination in the world. For example, the OECD Metropolitan Government Survey 2013-14 shows that 52% of the 263 metropolitan areas with more than 500,000 inhabitants surveyed only have informal arrangements. In Latin America, the Metropolitan Area of Buenos Aires is an example of informal coordination between different levels of government and bodies. Generally, this form of governance, which takes the form of periodic meetings between officials of different municipal governments or officials from other levels, can be useful for exchanging information and coordinating specific actions in a very flexible manner, which does not require too many resources. However, there are important constraints to achieving credible medium or long-term commitments, as it does not have significant resources or formal mechanisms to enforce what has been agreed between the parties. In this sense, informal arrangements are not a suitable instrument for coordinating complex policies, such as the distribution of land use among municipalities or investments for the expansion of the urban transport network, because they require a broader horizon for implementation.

The second type of metropolitan coordination is characterized by sector-specific horizontal agreements between different municipalities. In essence, this modality focuses on promoting cooperation in order to reduce costs and take advantage of economies of scale in the provision of certain services.[4] One of the most common variants at this level is the signing of formal agreements between municipalities to organize collection services and treatment of solid waste, either through joint bidding or by subcontracting the service from smaller municipalities to the municipal body of a larger neighboring municipality.

While these arrangements may be a catalyst for the emergence of other instances of coordination in related aspects (e.g. coordination in waste collection may lead to the homogenization of recycling policies as well as of some environmental policies), they generally lack an integral vision of municipal development. In this sense, they are usually insufficient to solve the problems of policy fragmentation between different municipalities. They can, however, be the starting point for closer collaboration.

The third type of formal coordination mechanisms at the metropolitan level is one in which multi-sector institutions are created, whose governance is controlled by the entities that comprise them. For example, the Metropolitan Area of Rosario (Argentina) consists of 22 municipalities and counties, based on an agreement of voluntary association, in force since 2010, which provides municipal coordination of policies through the creation of metropolitan bodies such as the Metropolitan Coordination Body. Beyond their efforts to create coordination bodies in projects of common interest, the municipalities of the Rosario Metropolitan Area have also progressed in the discussion and elaboration of a joint development vision, through a 10-year strategic plan (Metropolis, 2014).

4. The economies of scale concept refers to the negative relationship between the average cost of providing a service, or performing an activity, and the size or magnitude of the service.

Table 5.1 Types of metropolitan governance modalities

Modality			Coordination	Legitimacy	Resources	Examples in Latin America
Informal coordination			High degree of flexibility.	Limited visibility.	Limited.	Informal coordination between municipalities and entities of the Greater Buenos Aires.
			Low capacity to influence decisions at higher levels of government.	Low legitimacy.	Lack of instruments to enforce agreements.	
Formal coordination	Intermunicipal - joint authorities	Sectorial	Cooperation and costs reduction for a specific purpose.	Limited accountability with citizens.	Few additional resources. Existing resources are mostly shared.	Intermunicipal agreements for the management of solid waste in various countries.
			Lack of a comprehensive vision of municipal development.			
		Multisectorial	Cooperation and costs reduction for a set of specific purposes.	Limited accountability with citizens.	They have budget and personnel, but not necessarily in significant proportions.	Metropolitan areas of Colombia.
			Can generate instances of greater coordination in new areas.	In general members are not directly elected.		
	Supramunicipal authorities	Unelected	The main objective is horizontal coordination.	Limited.	Not necessarily significant. Conditioned by the executive powers and the existence of its own budget.	Metropolitan committees in Mexico (Puebla-Tlaxcala for example); the government of the metropolitan region of Santiago, Chile.
			It is sometimes encouraged or led by the central government.			
		Elected	De facto coordination, although sometimes it does not cover the whole functional municipal area.	Great political legitimacy.	Not necessarily significant. Conditioned by the executive powers and the existence of its own budget.	There are no experiences of this kind of institutionalism in Latin America.
			Oftentimes they produce long-term strategic planning for the metropolitan area.	Adds another level of government. It is potentially more bureaucratic.		
	Special status of "metropolitan city" or special district		De facto coordination.	Great political legitimacy.	It has its own budget and personnel.	The Metropolitan District of Quito.
				Replaces the municipal level.		

Source: Author's elaboration using data from OECD (2015).

The example given by Rosario shows that multi-sectorial inter-municipal coordination can be a useful way of giving initial solutions to metropolitan problems and gradually building up more sophisticated mechanisms and institutions, especially if initial legitimacy is limited. In addition to allowing cost reduction through the use of economies of scale, inter-municipal

coordination may have other advantages, such as increasing municipalities' voice and bargaining power with other levels of the State and promoting the creation of instruments to manage greater resources. It can also improve land registers and property registries, which would increase municipal tax revenues (IMCO, 2010). The Inter-municipal Consortium for Development of the Northwest of Buenos Aires province (CODENOBA by its acronym in Spanish) in Argentina is a successful inter-municipal coordination experience, yet also highlights the challenges of this type of process (see Text box 5.5).

Text box 5.5 The Inter-municipal Consortium for Development of the Northwest of Buenos Aires province experience [a]

The Inter-municipal Consortium for Development of the Northwest of Buenos Aires province (CODENOBA by its acronym in Spanish) emerged in the mid-1990s from a voluntary agreement between 10 municipalities (currently 12) that belong to the Buenos Aires province, with approximately 300,000 habitants. It was created to respond to a specific problem (a major flood), but its objectives quickly mutated into regional development. At first, it functioned as an administrative council composed of mayors and a coordinator who, although paid by the provincial government, was elected by the board of directors. However, this scheme lacked a common and permanent technical structure to follow up the consortium's initiatives and provide a coordinated response to the region´s problems beyond isolated sectorial projects and was perceived as a network of municipalities rather than as an inter-municipal institution. In addition, coordination only occurred among mayors, without including municipal councils, and much less actors amongst civil society.

During the period 2002-05, CODENOBA worked together with the United Nations Educational, Scientific and Cultural Organization (UNESCO) and the French Directorate of Scientific and Technical Cooperation to develop an institutional strengthening project. This included a series of reforms that involved the establishment of a physical headquarters, an articulated decision-making policy, an annual budget, a deliberative assembly that represented municipal councils, and mechanisms to increase the capacity to formulate medium term projects. From that moment on, the consortium was able to coordinate ambitious projects such as the elaboration of a master plan for the region´s water supply and energy infrastructure works (such as the Henderson-Pehuajó-General Villegas electrical node). However, on several occasions these projects suffered implementation problems due to lack of funding at provincial or national level.

Despite these positive developments, the institutional structure of the consortium remains weak and the lack of a provincial and national regulatory framework generates uncertainty about the financing of projects as well as generating fragmentation in dialogue with other levels of government and state agencies.

a. This text box was created based on Maurice and Braun (2005).

The fourth type of coordination is characterized by the existence of sub-regional or metropolitan institutions, whose authorities are not directly elected by the population. Although it shares the main objective of cost reduction, this scheme frequently generates instances of coordination in areas that are not usually covered by horizontal agreements between municipalities. Colombia's metropolitan areas constitute an example of this coordination modality. According to current regulations, Colombian municipalities may decide, by the initiative of their mayors, to form a metropolitan area around a core municipality. For this purpose, the project must have the approval of one third of the municipal councils or have the support, via signatures, of at least 5% of the total citizens entitled to vote in the municipalities in question. After a period of debate, the initiative must be approved by popular consultation and, later, each metropolitan area defines the competencies, functions, financing and authorities of the metropolitan entity.

The existence of subregional or metropolitan institutions creates coordination opportunities in areas that are not usually covered by horizontal agreements between municipalities.

Bogota and Medellin, the two largest cities in Colombia, have developed initiatives for the creation of metropolitan areas based upon the same regulations. However, experiences differ significantly. While Bogota has not been able to form a metropolitan government, an established metropolitan governance structure already exists in Medellin, which seems to have contributed to effective solutions in such relevant issues as urban transport (see Text box 5.6).

Text box 5.6 Differences in governance of the Metropolitan Areas of Bogota and Medellin

The Metropolitan Area of the Aburra Valley, whose central nucleus is the city of Medellin, was officially created in 1980. At present, it is formed by 10 municipalities and has a population of just over 4 million inhabitants, where approximately two thirds live in the municipality of Medellin. The Metropolitan Board is the main decision-making body and is composed of the mayors of the municipalities that make up the metropolitan area, a councilor representing the Council of Medellin and a councilor representing the other councils. The metropolitan area is the administrative organization that is in charge of territorial planning, acts as the environmental authority and transport authority, and carries out infrastructure works. The director of the metropolitan area is elected by the Board from three candidates proposed by the mayor of the municipality of Medellin. The main sources of financing are a surcharge of 2 per 1000 on property taxes and an environmental surcharge on the same tax. These sources represent about 60% of the current income for the institution, and are supplemented by voluntary contributions from municipalities and other transfers. In order to carry out strategic planning for the metropolitan area, there is also a Metropolitan Planning Council, composed of the director of the metropolitan area, civil servants of the municipalities´ Planning Secretariats and a delegate of Medellin Public Companies (EPM, a firm owned by the Medellin municipality that provides energy, water, gas and telecommunications services). The Council also invites representatives of the business and Metro chambers and the environmental authority of the department of Antioquia to participate.

In the case of Bogota, there are clear diagnostics that reveal the need for greater policy coordination among the municipalities that form part of the metropolitan area (Bogota City Hall, 2011). Efforts to formally create the Metropolitan Area of Bogota have failed for a number

of reasons, including conflicting interests and incentives among the municipalities that make up the Savannah of Bogota, conflicts which are related to financing of the metropolitan body and the resulting potential distribution of power (Buelvas Ramírez, 2014). Thus, although some progress has been made in certain areas, it has not been possible to address the metropolitan problem in a multidimensional way.

Beyond the fact that the current metropolitan governance of Medellin also presents challenges and areas for improvement,a the differences in the effectiveness of the two cities' policies are evident. To take an example, let us look at transport policies. In Medellin, the multimodal operation of the Integrated Transportation System of the Aburrá Valley (SITVA by its acronym in Spanish), which integrates the Metro, the Metroplus (BRT) and the Metrocable throughout the metropolitan area, clearly stands out. Meanwhile, its equivalent in Bogota (Bogota's Integrated Public Transport System, SITP) is more fragmented, partly because of the long delay in defining the Bogota Metro project and the absence of a master plan regarding mobility that is integrated into the planning of the entire metropolitan area, as occurs in Medellin.

These differences translate into different levels of satisfaction with the habitat, transportation and public services of the two cities, with levels of satisfaction significantly higher in Medellin than in Bogota (see Table 1). In this sense, the differences mentioned in the previous paragraph are reflected in much higher levels of satisfaction with public transport in Medellin than in Bogota. Local government institutions and municipal management also enjoy greater citizen trust in Medellin: less than 8% of respondents believe that the municipal administration is not transparent, while in Bogota this figure exceeds 22%.

Table 1 Citizen perceptions on life in Bogota and Medellin in 2015

	Bogota	Medellin
Satisfaction with the city as a place of residence [a/]	3.3	4.2
Satisfaction with city investments [a/]	2.5	3.7
Satisfaction with drinking water services [a/]	4.2	4.4
Satisfaction with the electricity supply service [a/]	4.3	4.5
Satisfaction with street cleaning and waste collection services [a/]	3.8	4.4
Satisfaction with gas supply services [a/]	4.3	4.7
Satisfaction with sports and recreational services [a/]	3.5	4.0
Satisfaction with transportation services [a/]	2.9	4.0
Qualification of the Mayor's performance [b/]	2.5	3.6
Qualification of the government team's management [b/]	2.5	3.3
Considers that municipal administration is not very transparentc/ (%)	22.2	7.6

a/ It refers to the average level of satisfaction, on a scale of 1 to 5, with 1 being totally dissatisfied and 5 being totally satisfied.
b/ It refers to the average rating, on a scale of 1 to 5, 1 being very poor and 5 being very good.
c/ It refers to the percentage of respondents who consider that the municipal administration is not very transparent.

Source: Author's elaboration using data from the Citizen Perception Survey "Cómo Vamos" (2015), for Bogota and Medellin.

a. Some analysts suggest that in order to improve metropolitan plans and projects and develop more efficient mechanisms for monitoring the population and getting it engaged, greater human resources are required at a municipal level (Leyva, 2010).

A case similar to Colombia is that of Mexico's metropolitan regions. Although the Mexican Federal Constitution stipulates that there is no level of government between municipalities and states, it allows the municipalities to associate voluntarily to provide a solution to the provision of public services in metropolitan areas, but with certain limitations for other management issues or infrastructure investments (Arellano Ríos, 2014a). Within this framework, several states have formulated their own laws to facilitate metropolitan governance. According to the most recent information, 11 of the 59 metropolitan areas identified in 2010 were in states that have their own legal framework to define instruments and institutions for metropolitan management (Sedesol et al., 2012; Arellano Ríos, 2014b). Despite the differences between state regulations, in general, the modality of coordination involves three types of institutions: i) a supra-municipal political body (commission, council or metropolitan board) that defines the strategic guidelines, and which is usually composed of the state governor and the municipal authorities; ii) a technical body, subordinate to the political body, which helps to implement approved policies and projects; iii) a mechanism that allows for consultation with citizens.

Within the region there are few metropolitan areas designated by national authorities as "metropolitan cities" or special districts.

So far, there are no rigorous evaluations of the impacts on the living conditions of Mexican citizens due to the creation of these metropolitan governance mechanisms. However, the evidence provided by case studies illustrates that this coordination scheme is subject to a number of limitations. For example, an OECD study of the Puebla-Tlaxcala region from 2015 shows the remarkable predominance of state authorities (to the detriment of municipal authorities) in decision-making, leading to a lack of a long-term vision and the absence of a common policy in areas of relevance such as transport and land use. At the same time, the human and financial resources available to the technical institutions in Puebla-Tlaxcala are often limited (OECD, 2015).

Finally, in the region there are few metropolitan areas designated by the national authorities as "metropolitan cities" or special districts. In this case, the metropolitan government is above the local governments that comprise it, which implies that it is often comparable to a state, a province or a regional government and that it has directly elected officials. However, unlike experiences such as those of South Korea or Turkey, where these arrangements are common throughout the national territory, in Latin America they occur mainly in the capitals of some countries. Thus, while in Quito, a metropolitan district with an elected mayor and metropolitan council has been constituted, in Guayaquil (the metropolitan area with the largest population in Ecuador and, therefore, with the possibility of obtaining greater potential benefits from a metropolitan government structure) this type of governance has not yet been implemented.

While in Mexico only 20% of municipalities have some type of agreement with other municipalities, in Spain 75% coordinate with their peers.

Quantitative assessment of the scope of metropolitan governance in Latin America

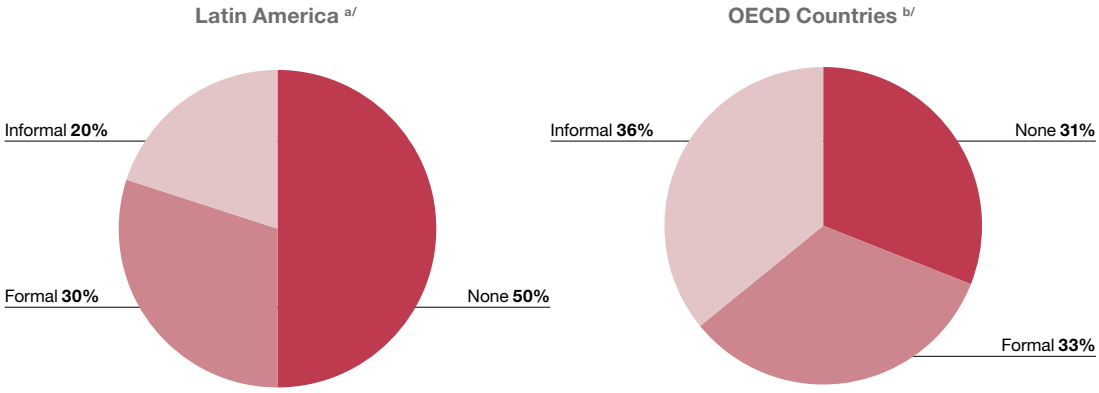
The lack of comparable sources of information for a wide range of Latin American cities means that in order to attempt to make an exhaustive diagnosis of the current situation of metropolitan governments in the region in relation to financial and human resources as well as policy tools of the kind that have to face these challenges, it is necessary to resort to multiple sources and case studies, which could be a limitation on the results presented in this section. The exception is the study by Lanfranchi and Bidart (2016), which compiles comparable information on aspects of governance in 64 metropolitan areas of the region with at least 1 million inhabitants in 2010 (using a methodology similar to that of OECD, 2015) and allows for some useful comparisons to be made both within the region and with other countries.[5]

A first aspect to consider refers to the existence (or lack thereof) of metropolitan governmental bodies and their attributions. On one hand, according to the answers given by specialists interviewed by Lanfranchi and Bidart (2016), in two thirds of the metropolitan areas there is a metropolitan plan, understood as a strategic, sectorial or territorial plan for the metropolitan area. At the same time, in more than three quarters of cases there is a regulation that sets metropolitan activities and relations. However, only half of the metropolitan areas have a metropolitan governing body, a fraction substantially lower than that observed in OECD countries (see Graph 5.4). On the other hand, this smaller number of metropolitan government institutions is due, in particular, to fewer informal agreements between local governments. For example, while in Mexico only 20% of municipalities have some type of agreement with other municipalities, in Spain 75% of municipalities coordinate with their peers through public policy agreements (IMCO, 2010).

As for the resources available to Latin American government agencies in Latin America, Lanfranchi and Bidart (2016) point out that in the 64 metropolitan areas analyzed in their study they vary between USD 10 million and USD 450 million year, and most metropolitan areas are in the range of USD 25 million to USD 75 million. This implies that the median metropolitan government has between USD 12 and USD 36 per capita. This figure is similar to the median budget available to supra-municipal entities in OECD countries (USD 14 per capita), but much lower than the figure of the inter-municipal authorities and the metropolitan cities for this group of countries (USD 184 and USD 2,759 per capita, respectively).

5. These metropolitan areas do not necessarily match those found with the methodology proposed in Chapter 1.

Graph 5.4 Metropolitan arrangements in Latin America and OECD countries



a/ For Latin America, metropolitan government bodies can be divided into: formal, when the governance scheme is defined by a written agreement by the parties; and informal, when constituted through an ad hoc authority.
b/ For OECD countries, metropolitan government bodies with regulatory powers based on flexible coordination arrangements are considered informal.

Source: Author's elaboration based on Lafranchi and Bidart (2016) and OECD (2015).

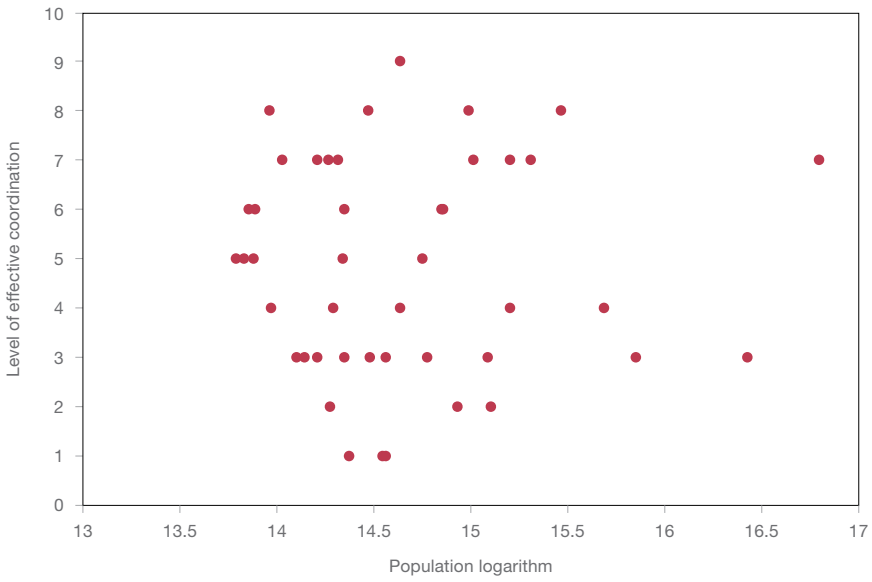
There are marked differences in the level of resources available to metropolitan governance bodies between cities in the region, even within countries. It is worth considering, for example, the case of the Sao Paulo Metropolitan Planning Company (Emplasa), the technical body in charge of the implementation of regional and sectorial policies of different sectors and levels of government in the metropolitan region of Sao Paulo (Brazil). In 2015, the institution had 206 employees and a budget of approximately USD 23 million per year, for a population of about 20 million inhabitants. This does not differ much from what happens in Chicago (the United States), where the metropolitan authority has a little more than 100 employees and spends approximately USD 17 million per year, with a population of around 9.5 million people. However, Sao Paulo (and some other metropolitan regions of Brazil) seems to be more the exception than the rule, since Rio de Janeiro does not have a similar organization despite having a population of almost 11 million inhabitants. Similarly, some of the larger Latin American cities (such as Buenos Aires and Lima) do not have significant metropolitan government institutions from the point of view of competencies and human and financial resources.

Another relevant dimension to take into consideration in terms of resources is whether metropolitan government agencies have their own funding or not, since this is generally related to the degree of independence of fiscal policy and of overall policy implementation. In this sense, the Lanfranchi and Bidart study (2016) reveals that 49 of the 64 metropolitan areas analyzed depend mainly on contributions from other levels of government (from local, regional or national governments). This means that 4 out of 5 cities do not have their own resources for metropolitan management.

The level of "effective coordination" in Latin America does not appear to be correlated with the size of the metropolitan area, unlike OECD countries.

Regarding how much coordination takes place at the metropolitan level in Latin America, although there seems to be a willingness to coordinate policies (only 4 out of 64 cases report no cooperation at all), the levels of coordination are often insufficient. At the same time, the level of "effective coordination" (as measured by an index that captures the coordination between sectorial bodies at the metropolitan level and the existence of agencies, regulations, plans and a climate of cooperation [Lanfranchi and Bidart, 2016]) does not appear to be correlated with the size of the metropolitan area (see Graph 5.5). This contrasts with the experience of OECD countries, where the level of coordination (as well as metropolitan human and financial resources) grows with the population of the metropolitan area (OECD, 2015).

Graph 5.5 Relation between effective coordination and the size of the metropolitan area for selected Latin American cities in 2010 [a/]



a/ The level of effective coordination is an index that measures the existence of intra and intersectoral instances of coordination in each metropolitan area. It can take values from 0 to 10; a higher value means greater coordination.

Source: Author's elaboration based on Lanfranchi and Bidart (2016).

Finally, in terms of representativeness, Lanfranchi and Bidart (2016) observe that only a third of the metropolitan bodies and institutions in the region have any representatives elected by popular vote.

To summarize, this analysis shows that metropolitan agencies are often scarce in the region, and when they exist they tend to be constituted by formal structures with little effective power due to the lack of significant financial

resources and coordination tools. This coincides with the assessment of policy makers in the 37 metropolitan areas that are part of the Metropolis Initiative on Metropolitan Governance.[6] More than a third of those interviewed point out that coordination problems and management fragmentation are the main challenges for metropolitan governance, followed by a lack of financial resources for the effective implementation of policies and the absence of a duly regionalized budget (Metropolis, 2014).

The financing of Latin American cities

Since Latin American metropolitan areas generally do not constitute a formal level of government that is separate from the municipal level, it is difficult to have accurate and comparable information across cities and countries regarding the composition of available financial resources. Cities can be financed through a combination of several elements: (i) own resources such as taxes or tariffs, or other non-tax revenues; ii) transfers from other levels of government, either from a higher level (national or regional government) or lower (contributions from the municipalities that make up the metropolitan area); iii) debt. Aspects related to own resources and some financing instruments for infrastructure investment are analyzed below.[7]

A first approach to this matter is to explore the available tax resources for Latin American subnational governments. The structure as well as the volume of resources available to this type of institution varies greatly within the region (see Table 5.2, p. 252). In general, the total volume of resources is higher in federal countries such as Argentina, Brazil and Mexico. The same happens in Colombia, which despite having a unitary territorial political organization, has a high degree of decentralization. However, there are significant differences in the structure of total revenues, even among federal countries. For example, while more than 75 percent of Brazil's subnational government resources are its own (more than 90 percent of which come from tax revenues), Mexico's subnational governments are mostly funded through transfers from the national government. Similarly, there are unitary countries such as Chile, Costa Rica and Uruguay where own resources constitute a larger proportion of income than in federal countries such as Argentina or Mexico. Finally, in Colombia and Peru, revenues from royalties and tariffs related to mining also constitute a relatively significant source of income.

6. This initiative mainly includes the metropolitan areas of Argentina, Brazil, Mexico and Peru, but also includes two metropolitan areas in South Africa and China (Metropolis, 2014).

7. CAF analyzed aspects related to fiscal relations between different levels of government as well as the capacity of subnational governments to access financing with loans or debt (2012).

A major issue affecting the collection of real estate taxes in Latin America is its lower capacity for management and tax administration.

Table 5.2 Structure of subnational governments total revenues in 2014 [a/]

Country	Own resources		Transfers		Other Income		Total
	% of GDP	% of total	% of GDP	% of total	% of GDP	% of total	% of GDP
Argentina	6.3	41.7	8.8	58	0.1	0.4	15.2
Brazil	11.1	75.1	3.7	24.8	0	0.1	14.8
Chile	2.1	60.5	1.4	39.1	0	0.4	3.5
Colombia	3.7	31.6	5	42.8	3	25.6	11.8
Costa Rica	1.1	99.8	0	0.1	0	0.1	1.1
Ecuador	1	21.6	3.6	77	0.1	1.3	4.6
Mexico	1.4	13.8	8.7	86.2	0	0	10.1
Peru	1.1	27.3	2.6	66.7	0.2	6	3.9
Uruguay	2	63.8	1.1	36.2	0	0	3.1
Average	**3.3**	**48.4**	**3.9**	**47.9**	**0.4**	**3.8**	**7.6**

a/ The subnational governments category includes local, regional and metropolitan governments.

Source: Author's elaboration based on OECD et al. (2017).

As for tax revenue sources, local governments in Latin America mainly have at their disposal taxes on real estate property. On one hand, this mirrors the situation in OECD countries; on the other hand, there are good arguments for economic efficiency that support a dependence on this source. That said, collection capacity differs significantly between the two groups of countries: while OECD nations collect an average of 1.9% of gross domestic product (GDP) in property taxes, in Latin America, revenues are less than half (0.8% of GDP in 2014 [OECD et al., 2017]). It should be noted that in several of the countries in the region, the collection of taxes on real estate and land is in the hands of regional governments (states or provinces) or even of the national government, which means that the revenue potential for cities may be limited. At the same time, as discussed below, alternative financing instruments based on land valuation are not currently used to their fullest potential.

There are many factors that explain the gap in the collection of real estate taxes, but a reduced capacity for management and tax administration is a preponderant factor, since these taxes have a relatively high administrative cost. In addition, tax rates are generally much lower in the region and it is common that cadastral values are outdated. In this sense, the incentives provided by higher levels of government can, with adequate technical criteria, help carry out land registers and keep them up to date. This is also an area where collaboration between municipalities can bear fruit. For example, a study about Mexico shows that inter-municipal coordination focused on improving tax revenues allowed for an increase in revenue associated with real estate by 60%

(IMCO, 2010). Likewise, updated land registers that include real estate market values would allow to collect part of the increased yields generated by public works for property owners, such as investment in transport infrastructure.

Table 5.3 shows other resources frequently used to finance cities and local governments in Latin America and the rest of the world. In matters of taxation, some OECD countries charge local taxes on personal income. However, given the high costs of managing and enforcing regulations for this tax, this does not seem a viable short-term option for increasing revenue in most Latin American cities.

Sales taxes and taxes on economic activities are another source of funding frequently used by regional and local governments in the region and the rest of the world. Nevertheless, these taxes can lead to high administrative costs and inefficiencies. In addition, they can be used to favor companies with other criteria than efficiency, and often erode the taxbase by producing fiscal competition between jurisdictions.

In this respect, there are initiatives in several of the region's countries to simplify the municipal tax structure. In Colombia, for example, although 80% of the municipal tax revenues come from three taxes (property, sales and gasoline surcharges), there are about 19 additional taxes and fees that collect little and significantly increase the cost of tax compliance for firms (Daude et al., 2015).

Table 5.3 Characteristics of the main potential sources of own resources

Source of resources	Administrative and control costs	Distorting effects	Aspects of collection of funds
Property tax on real estate	Relatively high.	Moderate; higher for firms.	Relatively stable source of income.
Local taxes on personal income	High.	Moderate.	Relatively volatile, potentially more progressive.
Sales tax	Moderate.	Low, although they can be greater if the rates are set locally.	It captures some of the benefits of local growth and makes daily travelers and visitors pay for some of the negative externalities they cause.
Tax on economic activities	Sometimes high, if there are exemptions and/ or differential rates by activity.	High, for encouraging fiscal competition between localities.	Can generate substantial collection of funds and is sensitive to local growth.
Congestion charges	Low, if the technology is well used.	Efficient due to a reduction in externalities.	"Smart" toll booths that can vary according to the time and type of vehicle.
Public transport charges	Moderate.	No.	Can ensure efficiency and the accountability in the provsion of services. Total cost recovery is generally infrequent.
Public parking rates	Low.	No.	They have a high price elasticity and can help reduce car use.
Other charges for the use of public services, (water, solid waste, etc.)	Moderate.	No.	Total cost recovery is the general rule in the OECD countries, but not necessarily in Latin America. Promotes incentives to preserve natural resources.

Source: Author's elaboration based on Bird and Slack (2008) and OECD (2015).

Public transport fares should reflect the social cost of service provision.

Regarding the design of public transportation fees, the scarcity of financial resources for cities and the importance of transportation and its externalities for the quality of life of the inhabitants make this a key issue in Latin American cities. Currently, most public transportation rates do not reflect the costs for the provision of services due to the existence of subsidies. The Metropolitan Area of Buenos Aires is an emblematic case for this situation (see Text box 5.7). As discussed in Chapter 3, economic and social arguments support subsidies for public transport. Similarly, positive externalities favor the existence of subsidies. In fact, tariffs do not usually reflect the fact that the mass use of public transport reduces commuting time for the general population (Small and Gómez Ibáñez, 1999), as well as reducing pollution and the number of travel accidents. Thus, each additional trip on the public transport system favors not only each individual who uses it but also society as a whole, which is why promoting the use of these means through generalized subsidies produces benefits. Meanwhile, private car transport involves negative externalities of congestion, pollution and accidents (see Chapter 3) and, therefore, produces social costs. Therefore, public transport fares should reflect the social cost of service provision (where the externalities or social benefits generated are discounted).

Text box 5.7 Urban transport subsidies in the Metropolitan Area of Buenos Aires

Urban transport subsidies in the Metropolitan Area of Buenos Aires (buses, trains and subways) increased from 0.2% of GDP in 2005 to almost 1.3% in 2013, which represented a change from 20% of their income to almost 80% during the same period. Given their revenue structure, based primarily on state subsidies, these transport companies have had few incentives to invest in improvements, and the service has thus deteriorated (ASAP, 2014). From a distributive point of view, bus transportation subsidies in the Metropolitan Area of Buenos Aires are relatively progressive, while rail transportation subsidies favor households in the highest quintiles of income distribution. However, even for bus transportation, there are ways of modifying the subsidy structure by targeting subsidized rates for poor households to expand coverage for this sector of the population (Lakner et al., 2016).

Another argument supporting public transport subsidies has to do with equity or the fact that prices that reflect the social cost could exclude people who cannot pay for the service. In this sense, when designing these subsidies, it is important to clearly define the groups that they are intended to favor, so that subsidies can benefit the people who really need them. The same is true regarding tariffs of other public services, such as water. In summary, policies should be designed in such a way that tariffs reflect the social costs of providing the service for those who have the ability to pay, while subsidized schemes should focus on the segment of society that is

not able to pay as much as possible.[8] The implementation of this type of policy represents a challenge for cities, since it seeks to make services economically sustainable, while at the same time maximizing access to them. Oftentimes these policies are decided at the national government level. However, it is clearly relevant for local governments, especially metropolitan ones, to assume a role in their design and implementation, given their proximity to users.

Infrastructure works generate valuation gains for landowners and surrounding properties, which could be used to finance these investments.

At the same time, it is often insufficient to attempt to recover the costs of major transport infrastructure works, such as the creation of a BRT or metro system, exclusively through user fees. However, these works generate valuation gains for the land owners and owners of the surrounding property, due to the greater accessibility of land and property. A portion of these gains could be used to finance these investments. In the case of South Korea, Cervero and Kang (2011) show that the implementation of the Seoul BRT system created incentives for real estate owners to convert single family homes into properties with multiple housing units, given the increase in between 10% and 25% in land prices for dwellings between 300 and 150 meters away from a BRT stop. Similarly, in the case of the Transmilenio in Bogotá, Rodríguez and Targa (2004) have found that rental prices for houses fall between 7% and 9% for every 5 minutes of additional time taken to walk to a station belonging to the system.

Thus, cities could recover part of the increase in value generated from public investment in infrastructure by relying on value capture instruments of these improvements, particularly in public transport (see Chapter 2). For example, in Colombia, contributions based on improved valuations made it possible to finance 1 billion USD worth of public investments in 2011 (Borrero Ochoa, 2013). However, the experience in the region shows large variations in the implementation of this type of value capture. Political factors such as the determination of local governments to finance investments through these mechanisms, good coordination among tax, judicial and planning authorities, and the state's capacity to monitor property and land markets, as well as a valuation of these assets, are all important when it comes to successfully implementing these schemes. At the same time, citizen involvement through information and consultation processes can also help to give greater political viability to the introduction of these kinds of contributions (Smolka, 2013).[9]

8. Targeting requires good information system about households such that it does not exclude those who should receive a subsidy or include those with large incomes who should not receive a subsidy. Problems like these can lead to horizontal inequities that could justify the establishment of universal subsidies while the country develops the capacity to improve targeting.

9. The voluntary payment of municipal taxes is an interesting scheme that was implemented in Bogota in 2002. It allows taxpayers to choose the public investment project to which they would like to contribute.

How to improve metropolitan governance

International experience, including that of Latin America and supported by the discussion in this chapter, indicates that beyond formal institutional arrangements, the factors that explain the success of metropolitan governance are often related to implementation, the availability of human and financial resources, and stable political alliances that adapt governance to the needs of the metropolitan area. This implies that, rather than trying to implement solutions that are theoretically the best way to respond to coordination failures between policies and levels of government, reforms should probably start from the institutional, political and economic reality of each metropolitan area and be incremental. Latin American cities need to learn from the successes and mistakes of the past, and from experiences that were often based on arbitrary answers justified by technically sound arguments, but lacking the means and political support to be sustainable.

It is fundamental that all proposed solutions enjoy legitimacy. However, in the region, the relationship between citizens and those that govern its cities often begins with mutual mistrust. The dynamics of economic and social segregation only serve to nurture this mistrust. For example, the presence of the metropolitan government (and other levels of government) in slums is almost non-existent. Thus, the marginalization felt by its inhabitants due to the lack of access to essential public services is added to the fact that, in general, the few experiences of interaction with authorities responsible for public policies are negatively valued. In the case of the "Villa 21-24" neighbourhood in Buenos Aires, only a section has managed to regularize land titles and housing, as well as access to public services, while the rest of the neighborhood remains in a vulnerable situation. According to a qualitative study, prepared for this report, the perception of most the zone's inhabitants who were interviewed is that these differences are due to institutional weaknesses and inefficiencies (Lacabana, 2017). In this sense, the low credibility and the low legitimacy of different levels of government should be a factor to be considered when thinking about possible governance reforms.

At the same time, the political fragmentation that exists in many of the region's metropolitan areas results in strong political support for the maintenance of the status quo (i.e., the lack of coordinated solutions), at least in the more affluent municipalities. This can create significant barriers to change in urban development policies, since wealthier municipalities would refuse to finance policies that benefit other parts of the metropolitan area. Therefore, progress is more likely to have a lasting effect if it is harmonious across all key dimensions, including building administrative capacities, accountability mechanisms, and citizen involvement in management. In addition, given the potential barriers to change, it is necessary to think of incentive mechanisms that can be established by higher levels of government to facilitate a stable cooperation system, without ignoring the need for reaching certain agreements with local governments, especially if they enjoy a high degree of political legitimacy.

In many cases, a country's political organization also imposes significant restrictions on what can be achieved in the short term for the creation of supramunicipal institutions. In countries with federal structures, the national government can generally delegate the creation and implementation of metropolitan governments to the states/provinces, as well as the design and management of appropriate incentives to facilitate collaboration among municipalities. This has been the case in Brazil, where the 1988 Constitution delegated this function to the individual states. In this way, the Brazilian states have a powerful set of tools to respond to the challenges of metropolitan governance.

However, this does not mean that the potential has always been fully used. For example, the Bello Horizonte metropolitan region evolved from a technocratic structure, centralized within the Metropolitan Plan's Executive Group (Plambel), and inherited from the dictatorship, to a new structure that, although it does not allow for direct elections, has representation of the state Legislative Power and the Executive Power, as well as of the 34 municipalities that comprise the metropolitan region. The Agency for the Development of the Metropolitan Region, a completely technical entity, supports this management. In addition to having a master plan for integrated development, Bello Horizonte has the Metropolitan Development Fund, which funds investment programs and projects in the metropolitan region and is supported by contributions from the Minas Gerais State (50%) and proportional contributions from municipality funds (the remaining 50%). It has also introduced an instrument for consultation with civil society: the metropolitan conference, which meets every two years (Metropolis, 2014).

This contrasts, for example, with the case of the metropolitan region of Rio deJaneiro, where until 1989 there was only the Foundation for the Development of the Metropolitan Region of the Rio de Janeiro State (Fundrem), a relatively weak institution that was not replaced by another structure of government after its disappearance. This generated a significant fragmentation in the management of the metropolitan region. Only in 2011, partly to coordinate the construction projects for the 2016 Olympic Games, was the Executive Committee of Metropolitan Strategies established, albeit with very limited powers. The limited experience at a metropolitan level of coordinating policies in Rio de Janeiro seems to be one reason why the infrastructure designed for the Olympics is not used and that, in general, the potential benefits of positive transformation for the city have not materialized, as they did in Barcelona in 1992.[10]

Another factor that often limits the implementation of effective solutions is related to political economy. In particular, local politicians can (and often do) have incentives that differ from what would be socially optimal. Therefore, there is often a bias towards more visible short-term projects, which allow for immediate "achievements" to be made before the end of a government's term in power, to the detriment of longer-term initiatives that would have a greater impact from a social perspective, but that would very possibly be inaugurated by

10. For more details, refer to Armendáriz (2017).

The incentives for politicians to focus on common good are strengthened when more controls exist.

another politician. In Mexico, this bias has been exacerbated by the restriction for mayors to be re-elected. The 2013 political reform was responsible for this modification, but it is still too early to measure its effects. In Colombia, although the re-election of mayors is allowed, they cannot be re-elected in two consecutive periods, which does not solve the problems discussed in this paragraph. The incentives for politicians to have a greater focus on the common good are strengthened when more controls exist, either from the media and citizens or through judicial institutions (Ferraz and Finan, 2008).

The asymmetries of power between the core municipality and other municipalities that make up the metropolitan area frequently represent a brake on greater political integration, since small municipalities fear the loss of political power. Thus, many cases of metropolitan reform compensate the smaller municipalities by giving them incentives to cooperate. In Finland, for example, the law foresees a reduction in the power of the Helsinki Metropolitan Council if new municipalities join. Similarly, in Lyon, the central municipality of Lyon decided to give up seats in the community council and lose an absolute majority in exchange for smaller municipalities joining the governance institutions (OECD, 2015).

Text box 5.8 The effects of participative budgets in Brazilian cities

In the region, rigorous assessments on the effects of innovation on governance at the municipal or metropolitan level are scarce. This is mainly due to the difficulty of isolating the effect of a concrete institutional reform from other unobserved or complex variables of measurement that may influence the probability of carrying out these reforms, as well as their results. Therefore, in general, it is not feasible to go beyond a case study that is complemented by simple correlation analyses.

However, in the case of Brazil there are fairly detailed municipal data to conduct a relatively good evaluation of the impact of the introduction of participatory budgeting (PP) on municipalities. For a sample of 253 municipalities with more than 100,000 inhabitants, Touchton and Wampler (2014) used matching techniques that made it possible to evaluate the impact of PP in the absence of a control group and a randomly assigned procedure. The authors found that the implementation of a PP process had a positive effect on changing the composition of public investment towards items related to welfare, in particular that of the most vulnerable sectors of the population. Specifically, between 1989 and 2008, spending on health and sanitation increased by an average of 6% in municipalities that applied a PP compared to similar municipalities that did not. In addition, the authors indicate that PP implementation is associated with an 11% decrease in infant mortality rates.

Likewise, the study shows that in municipalities that implemented PP processes there is an increase in the number of local NGOs, in comparison with similar municipalities that did not apply PP. This coincides with the more qualitative evidence from other studies that argue that PPs also had positive effects on citizen participation and democracy in Brazil (Baiocchi et al., 2011).

Promoting citizen participation is key, both to achieve sustainable governance reforms and to control and improve municipal management. Instruments such as participatory budgeting, where citizens are consulted and allowed to choose concrete projects to invest in, can be useful for incorporating people's preferences into urban policies. In Brazil, there is evidence that participatory budgeting schemes can lead to an improvement in the population's wellbeing, particularly among the most vulnerable sectors (see Text box 5.8). However, it is important for projects to be technically sound and for management to be appropriate.

It is essential that metropolitan and/or local governments have the capacity as well as the incentives to provide timely information to inhabitants about planned projects and consultation processes.

In order for citizen participation to have the desired effect, it is essential that metropolitan and/or local governments have the capacity as well as the incentives to provide timely information to inhabitants about planned projects and consultation processes. In this sense, information and communication technologies (ICTs) and e-government instruments present an opportunity to reach citizens at a lower cost. However, the current use of these platforms is relatively scarce. It is also reasonable to think that for some sectors, especially the poorest, participation and access to information would be more expensive, so it is important to reduce the cost of interaction with the State and ensure proper representation for various interests (CAF, 2015).

Policy improvements require good diagnostic tools. To do this, more and better information is needed with regard to the current situation of Latin American cities. As discussed in Chapter 2, there are very little data today on key issues such as the incidence, extent, evolution and status of slums. It is difficult to conceive that metropolitan policies can be effective if they do not possess good information systems or accurate measurement and diagnostic tools.

Likewise, the need to develop solid monitoring and evaluation institutions and processes must be emphasized. This holds true for the great majority of public policies, including, of course, for metropolitan governance reforms. In several OECD countries, proposals for independent technical experts to define new administrative boundaries for cities enjoy extensive community consultation and are often implemented considering experimentation periods and specific pilot schemes. Sweden, for example, initiated the implementation of a municipal consolidation program with a multi-year pilot program and specific intermediate evaluation mechanisms in two regions, and then extended it to six other metropolitan regions (OECD, 2015).

Conclusions

The analysis presented in this chapter shows the importance of metropolitan governance. This is because differences between functional and administrative definitions of metropolitan areas result in coordination and fragmentation failures. These two factors reduce policy effectiveness to respond to metropolitan problems.

Although there are marked differences between metropolitan institutions between different countries, as well as those within countries, many Latin American cities have weak metropolitan governance due to a lack of capacities, resources and political legitimacy, which limits the possibilities of coordinating policies and increasing the productivity of cities and the wellbeing of their inhabitants.

To create more effective governance, it is necessary to move forward on three levels: to create more state capacities for metropolitan management, to establish institutions and tools that can provide concrete solutions to key coordination problems at the metropolitan level, and to promote citizen participation and accountability.

BIBLIOGRAPHY

BIBLIOGRAPHY

Abrahams, A., Lozano-Gracia, N. and Christopher, O. (2017). *A New Method for Deblurring DMSP Nighttime Lights*. Working paper. Retrieved from https://sites.google.com/site/alexeiabrahams/alexeis-files-for-download

Acemoglu, D., Johnson, S. and Robinson, J. A. (2002). Reversal of Fortune: Geography and Institutions in the Making of the Modern World Income Distribution. The Quarterly Journal of Economics, 117(4), 1231-94.

Across Latitudes and Cultures - Bus Rapid Transit (ALC-BRT), the Latin American Association of Integrated Systems for Sustainable Urban Mobility (SIMUS), EMBARQ and the International Energy Agency (IEA). Global BRTData. Version 3.24. Modification: May 2, 2017. Available at: http://www.brtdata.org

Agarwal, O. P., Padam, G. and Ibraimova, C. (2014). *Formulating an Urban Transport Policy: Choosing between Options*. World Bank. ESMAP Paper No. 89025.

Ahrend, R., Farchy, E., Kaplanis, I. and Lembcke, A. C. (2017). What Makes Cities More Productive? Evidence from Five OECD Countries on the Role of Urban Governance. Journal of Regional Science, 57(3), 385-410.

Ahrend, R., Gamper, C. and Schumann, A. (2014). *The OECD Metropolitan Governance Survey: A Quantitative Description of Governance Structures in Large Urban Agglomerations*. OECD. Regional Development Working Paper No. 2014/04.

Akbar, P. A. and Duranton, G. (2017). *Measuring the Cost of Congestion in Highly Congested City:* Bogota. CAF. Working paper No. 2017/04.

Akhmouch, A. (2012). *Water Governance in Latin America and the Caribbean: A Multi-Level Approach*. OECD. Regional Development Working Paper No. 2012/04.

Alcalá, A. and Hernández, D. (2016). *Encuestas de movilidad, oportunidades, dilemas técnicos, institucionales y de política pública. El caso de la encuesta de movilidad del área metropolitana de Montevideo.* CAF. Working paper No. 2016/11.

Allport, R. and Thomson, J. (1990). *Study of Mass Rapid Transit in Developing Countries* (Report No. 188). Crowthorne, United Kingdom: Transport and Road Research Laboratory (TRL).

Alonso, W. (1964). *Location and Land Use: Toward a General Theory of Land Rent*. Cambridge, USA: Harvard University Press.

Alves, G. (2016). *Slum Growth in Brazilian Cities*. CAF. Working paper No. 2016/10.

Alzúa, M. L., Amendolaggine, J., Cruces, G. and Greppi, C. (2016). *Housing Subsidies, Labor Supply and Household Welfare. Experimental Evidence from Argentina*. CAF. Working paper No. 2016/11.

Anderson, M. (2014). Subways, Strikes, and Slowdowns: The Impacts of Public Transit on Traffic Congestion. American Economic Review, 104(9), 2763-96.

Andersson, F., Haltiwanger, J. C., Kutzbach, M. J., Pollakowski, H. O. and Weinberg D. H. (2014). *Job Displacement and the Duration of Joblessness: The Role of Spatial Mismatch*. NBER. Working paper No. 20066.

Angel, S., Blei, A., Parent, J., Lamson-Hall, P. and Galarza Sánchez, N. (with Civco, D., Qian Lei,

R. and Thom, K.). (2016a). *Atlas of Urban Expansion. Areas and Densities* (2016 edition, volume 1). New York University; Nairobi, Kenya: UN-Habitat and Cambridge, USA: Lincoln Institute of Land Policy.

Angel, S., Lamson-Hall, P., Madrid, M., Blei, A. and Parent, J. (with Galarza Sánchez, N. and Thom, K.). (2016b). Atlas of Urban Expansion. Blocks and Roads. (2016 edition, volume 2). New York University; Nairobi, Kenya: UN-Habitat and Cambridge, USA: Lincoln Institute of Land Policy.

Arceo, E., Hanna, R. and Oliva, P. (2015). Does the Effect of Pollution on Infant Mortality Differ Between Developing and Developed Countries? Evidence from Mexico City. Economic Journal, Royal Economic Society, 126(591), 257-80.

Arellano Ríos, A. (2014a). Los mecanismos para la gestión metropolitana en los países federales de América Latina. Revista de Análisis Público, 3, 13-36.

Arellano Ríos, A. (2014b). La coordinación metropolitana en el ámbito subnacional mexicano: un análisis institucional. *Documentos y Aportes en Administración Pública y Gestión Estatal*, 23, 33-70.

Armendáriz, A. (February 18, 2017). El abandono amenaza con convertir en elefantes blancos las instalaciones de los Juegos de Río 2016. Diario La Nación. Retrieved from: http://www.lanacion.com.ar/1985717-el-abandono-amenaza-con-convertir-en-elefantes-blancos-las-instalaciones-de-los-juegos-de-rio-2016

Arrosa, M. L. and Gandelman, N. (2016*). Valuation of Public Amenities and Differences in Quality of Life among Latin American Cities*. CAF. Working paper No. 2016/14.

ASAP (Asociación Argentina de Presupuesto y Administración Financiera Pública) (2014). Subsidies and transport fare allowances. Retrieved from: http://www.asap.org.ar/wordpress/wp- content/uploads/2014/10/Infosubtransporte.pdf

Atlas of Urban Expansion (AUE, 2016). Database available at: http://www.atlasofurbanexpansion. org/data

Attanasio, O. and Mesnard, A. (2006). The Impact of a Conditional Cash Transfer Programme on Consumption in Colombia. Fiscal Studies, 27(4), 421-42.

Baiocchi, G., Heller, P. and Silva, M. K. (2011). *Bootstrapping Democracy: Transforming Local Governance and Civil Society in Brazil*. USA: Stanford University Press.

Bairoch, P. (1991). *Cities and Economic Development: From the Dawn of History to the Present*. USA: University of Chicago Press.

Balcombe, R. (ed.), Mackett, R., Paulley, N., Preston, J., Shires, J., Titheridge. and White, P. (2004). *The Demand for Public Transport: A Practical Guide* (Report No. 593). Crowthorne, United Kingdom: Transport and Road Research Laboratory (TRL).

Balsa, A. I., Bloomfield, J. and Caffera, M. (2014). *The Effect of Acute and Intensive Exposure to Particulate Matter on Birth Outcomes in Montevideo*. IDB. Working paper No. 534.

Barnett, R. (1997). Subsidiarity, Enabling Government, and Local Governance. *In* Hobson, P. A. and St. Hilaire, F. (eds.), *Urban Governance and Finance: A Question of Who Does What* (pp. 59-78). Montreal, Canada: Institute for Research on Public Policy.

Barnhardt, S., Field, E. and Pande, R. (2017). Moving to Opportunity or Isolation? Network Effects of a Randomized Housing Lottery in Urban India. *American Economic Journal: Applied Economics*, 9(1), 1-32.

Basso, L. J. and Silva, H. E. (2014). Efficiency and Substitutability of Transit Subsidies and Other Urban Transport Policies. *American Economic Journal: Economic Policy*, 6(4), 1-33.

Bates, R. H. (2005). *Markets and States in Tropical Africa: The Political Basis of Agricultural Policies: With a New Preface*. USA: University of California Press.

Baum-Snow, N. (2007). Did Highways Cause Suburbanization? *The Quarterly Journal of Economics*, 122(2), 775-805.

Baum-Snow, N. and Lutz, B. F. (2011). School Desegregation, School Choice, and Changes in Residential Location Patterns by Race. American Economic Review, 101(7), 3019-46.

Baum-Snow, N., Brandt, L., Henderson, J. V., Turner, M. A. and Zhang, Q. (2017). Roads, Railroads and Decentralization of Chinese Cities. The Review of Economics and Statistics, 99(3), 435-48.

Bertaud, A. (2004). *The Spatial Organization of Cities: Deliberate Outcome or Unforeseen Consequence?* University of California at Berkeley, Institute of Urban and Regional Development. Working paper No. 2004-01. Retrieved from: http://escholarship.org/uc/item/5vb4w9wb

Bertaud, A. and Malpezzi, S. (2003). *The Spatial Distribution of Population in 48 World Cities: Implications for Economies in Transition*. University of Wisconsin, The Center for Urban Land Economics Research.

Bertaud, A. and Malpezzi, S. (2014). *The Spatial Distribution of Population in 57 World Cities: The Role of Markets, Planning, and Topography*. Retrieved from: http://coller.tau.ac.il/sites/nihul.tau.ac.il/files/media_server/Recanati/management/elrov/june2014_symposium/Malpezzi.pdf

Bharadwaj, P., Gibson, M., Graff Zivin, J. and Neilson, C. (2014). *Gray Matters: Fetal Pollution Exposure and Human Capital Formation*. NBER. Working paper No. 20662.

Biderman, C. (2008). *Informality in Brazil: Does Urban Land Use and Building Regulation Matter?* Lincoln Institute of Land Policy. Working paper No. WP08CB1.

Bird, R. and Slack, E. (2008). Fiscal Aspects of Metropolitan Governance. In Rojas, E., Cuadrado-Roura,

J. and Fernández Güell, J. M. (eds.), Governing the Metropolis: Principles and Cases (pp. 193-259). Inter-American Development Bank and David Rockefeller Center for Latin American Studies, Harvard University. Washington, DC: IDB.

Black, D. and Henderson, V. (2003). Urban Evolution in the USA. *Journal of Economic Geography*, 3(4), 343-72.

Bleakley, H. and Lin, J. (2012). Portage and Path Dependence. *The Quarterly Journal of Economics*, 127(2), 587-644.

Boarnet, M. G., Houston, D. and Spears, S. (2013). *The Exposition Light Rail Line Study: "Before-After" Opening Travel Impacts and New Resident Sample Preliminary Analysis*. Lincoln Institute of Land Policy. Working paper No. WP13MB.

Bogota City Hall (2011). Public policy guidelines for regional integration. District Planning Secretariat. Retrieved from: http://www.sdp.gov.co/portal/page/portal/ PortalSDP/SeguimientoPoliticas/ politicaIntegracionRegional/EstrategiaIntegracionRegional/PA002- 2LineamientosIntegracionRegional. pdf

Bonilla, J. A. (2016). *The More Stringent, the Better? Rationing Car Use in Bogota with Moderate and Drastic Restrictions*. World Bank. Working paper No. WPS7846.

Borrero Ochoa, O. (2013). *Contribución de valorización o mejoras en Colombia. Análisis de la experiencia colombiana*. Lincoln Institute of Land Policy. Working paper No. WP14OB1SP.

Botero, M. H., Gartner, C. E., Chitiva, D. H. and Gómez, C. (2017). *Estudio cualitativo de asentamientos urbanos en* Bogota. CAF. Unpublished paper.

Briones, I. (2009). Transantiago: un problema de información. Estudios Públicos, 16, 37-91.

Brueckner, J. K. (1987). The Structure of Urban Equilibria: A Unified Treatment of the Muth-Mills Model.

In Mills, E. S. (ed.), *Handbook of Regional and Urban Economics*, 2(20), 821-45. Amsterdam: Elsevier.

Brueckner, J. K. (2001). Urban Sprawl: Lessons from Urban Economics. In Gale, W. G. and Pack, J. R. (eds.), Brookings-Wharton Papers on Urban Affairs, 2001(1), 65-97. Washington, DC: Brookings Institution.

Buelvas Ramírez, D. L. (June, 2014). Gobernanza metropolitana: urbanización y organización territorial en la Sabana de Bogotá. In *VI Seminario Internacional de Investigación en Urbanismo*, Barcelona-Bogotá, Colombia. Retrieved from: http://upcommons.upc.edu/ handle/2099/15947

Bull, A. (ed.) (2003). *Traffic Congestion: The Problem and How to Deal with it*. ECLAC Notes No.

87. Santiago de Chile: ECLAC.

Burchfield, M., Overman, H. G., Puga, D. and Turner, M. A. (2006). Causes of Sprawl: A Portrait from Space.

The Quarterly Journal of Economics, 121(2), 587-633.

Bureau of Statistics and Census of the City of Buenos Aires (DGEyC, 2016). Gross domestic product data downloaded in December 2016. Available at: https://www. estadisticaciudad.gob.ar/eyc/?page_id=1512

CAF - Development Bank of Latin America (2010). *Local development: towards a new protagonism of cities and regions*. Report on Economic Development. Caracas: CAF.

CAF - Development Bank of Latin America (2011). *Desarrollo urbano y movilidad en América Latina*. Caracas: CAF.

CAF - Development Bank of Latin America (2012). *Public Finance for Development: Strengthening the connection between income and expenditure*. Report on Economic Development. Caracas: CAF.

CAF - Development Bank of Latin America (2015). *A More Effective State. Capacities for designing, implementing and evaluating public policies.* Report on Economic Development. Caracas: CAF.

CAF - Development Bank of Latin America (2016). Extension of Metropolitan Area Database (BEAM). Data available at: https://www.caf.com

CAF - Development Bank of Latin America (2016). Survey on access to, quality of and satisfaction with public services in Latin America. Data available at: https://www.caf.com/es/temas/i/ investigacion-para-el-desarrollo/encuesta-caf/

CAF - Development Bank of Latin America (2016). *More skills for work and life: The contributions of families, schools, jobs, and the social environment.* Report on Economic Development. Caracas: CAF.

CAF - Development Bank of Latin America (2017). Urban Mobility Observatory (UMO). Data available at: https://www.caf.com/es/temas/o/observatorio-de-movilidad-urbana/bases-de-datos/

Canavire-Bacarreza, G., Duque, J. C. and Urrego, J. A. (2016). *Moving Citizens and Deterring Criminals: Innovation in Public Transport Facilities.* CAF. Working paper No. 2016/15.

Carr, J. B. and Feiock, R. C. (2004). *City-County Consolidation and Its Alternatives: Reshaping the Local Government Landscape*. New York: M.E. Sharpe.

Carrillo, P. E., López, A. and Malik, A. (2016). *Pollution or Crime: The Effect of Driving Restrictions on Criminal Activity*. IDB. Working paper No. 698.

Carrillo, P. E., Malik, A. and Yoo, Y. (2016). Driving Restrictions That Work? Quito's Pico y Placa Program.

Canadian Journal of Economics, 49(4), 1536-68.

Carruthers, R., Dick, M. and Saurkar, A. (2005). *Affordability of Public Transport in Developing Countries*. World Bank. Transport Paper Series No. TP-3.

Cattaneo, M. D., Galiani, S., Gertler, P. J., Martínez, S. and Titiunik, R. (2009). Housing, Health, and Happiness. *American Economic Journal: Economic Policy*, 1(1), 75-105.

Center for Distributive, Labor and Social Studies (CEDLAS. 2017). Socio-Economic Database for Latin America and the Caribbean. CEDLAS- UNLP. Unpublished working paper.

Cervero, R. (2001). Informal Transit: Learning from the Developing World. Access Magazine, 18(3), 15-22.

Cervero, R. and Kang, C. D. (2011). Bus Rapid Transit Impacts on Land Uses and Land Values in Seoul, Korea. Transport Policy, 18(1), 102-16.

Ch, R., Martín, D. and Vargas, J. F. (2017). *Urban Sprawl using Nighttime Lights*. CAF. Unpublished paper.

Champernowne, D. G. (1953). A Model of Income Distribution. *The Economic Journal*, 63(250), 318-51.

Chauvin, J. P., Glaeser, E., Ma, Y. and Tobio, K. (2017). What is Different about Urbanization in Rich and Poor Countries? Cities in Brazil, China, India and the United States. Journal of Urban Economics, 98, 17-49.

Chetty, R., Hendren, N. and Katz, L. F. (2016). The Effects of Exposure to Better Neighborhoods on children: New Evidence from the Moving to Opportunity experiment. American Economic Review, 106(4), 855-902.

Chiquier, L. and Lea, M. (2009). *Housing Finance Policy in Emerging Markets*. Washington, DC: World Bank.

CIPUV-UTDT (Universidad Torcuato Di Tella Urban Policy and Housing Research Center) (2016). Metropolitan Area of Buenos Aires land price atlas. Data available at: http://atlas-cipuv.utdt.edu/

Combes, P. P., Duranton G. and Gobillon, L. (2016). *The Costs of Agglomeration: House and Land Prices in French Cities*. Unpublished paper. Retrieved from: http://real.wharton.upenn.edu/~duranton/Duranton_ Papers/Current_Research/UrbanCosts.pdf

"Cómo vamos" (2015) public opinion survey. Collection of survey results and objective indicators for Medellín and Bogotá. Data downloaded in July 2017. Available at: http://www.ciudatos.com/datos

Cruces, J. J. (2016). *Argentina's Residential Real Estate Sector: A Magnet for Savings amidst Mistrust in Traditional Investment Vehicles*. IDB. Technical note No. 911.

Cullen, J. B. and Levitt, S. D. (1999). Crime, Urban Flight, and the Consequences for Cities. *The Review of Economics and Statistics*, 81(2), 159-69.

Currie, J., Neidell, M. and Schmieder, J. F. (2009). Air Pollution and Infant Health: Lessons from New Jersey. Journal of Health Economics, 28(3), 688-703.

Cutler, D. M. and Glaeser, E. L. (1997). Are Ghettos Good or Bad? *The Quarterly Journal of Economics*, 112(3), 827-72.

Daude, C., Perret, S. and Brys, B. (2015). *Making Colombia´s Tax Policy More Efficient, Fair and Green*. OECD Economic Department Working Papers No. 1234.

Davis, L. (2008). The Effect of Driving Restrictions on Air Quality in Mexico City. *Journal of Political Economy*, 116(1), 38-81.

De Soto, H. (2000). *The Mystery of Capital: Why Capitalism Triumphs in the West and Fails Everywhere Else.* New York: Basic Books.

Deng, L. (2007). Comparing the Effects of Housing Vouchers and Low-Income Housing Tax Credits on Neighborhood Integration and School Quality. *Journal of Planning Education and Research,* 27(1), 20-35.

Díaz-Olvera, L., Plat, D. and Pochet, P. (2008). Household Transport Expenditure in Sub-Saharan African Cities: Measurement and Analysis. Journal of Transport Geography, 16(1), 1-13.

DiPasquale, D. and Glaeser, E. (1999). Incentives and Social Capital: Are Homeowners Better Citizens?

Journal of Urban Economics, 45(2), 354-84.

Dittmar, J. E. (2011). Information Technology and Economic Change: The Impact of the Printing Press. *The Quarterly Journal of Economics*, 126(3), 1133-72.

DIVA-GIS (2017). Geographic data mapping and analysis program (a geographic information system, or GIS). Administrative boundaries. Data downloaded on April 15, 2017. Available at: http://www.diva-gis.org/Data

Duarte, J. and Baer, L. (2013). *Recuperación de plusvalías a través de la contribución por mejoras en Trenque Lauquen, provincia de Buenos Aires, Argentina*. Lincoln Institute of Land Policy. Working paper No. WP14JD1SP.

Duflo, E. (2012). Women Empowerment and Economic Development. *Journal of Economic Literature*, 50(4), 1051-79.

Duque, J. C., Patino, J. E. and Betancourt, A. (2016). *Exploring the Potential of Machine Learning for Automatic Slum Identification from VHE Imagery*. CAF. Working paper No. 2016/13.

Duranton, G. (2007). Urban Evolutions: The Fast, the Slow, and the Still. *American Economic Review*, 97(1), 197-221.

Duranton, G. (2008). Viewpoint: From Cities to Productivity and Growth in Developing Countries.

Canadian Journal of Economics/Revue canadienne d'Économique, 41(3), 689-736.

Duranton, G. (2015). A Proposal to Delineate Metropolitan Areas in Colombia. Desarrollo y Sociedad, 75, 223-64.

Duranton, G. and Guerra, E. (2016). Urban Accessibility: Balancing Land Use and Transportation. Samuel Zell and Robert Lurie Real Estate Center, Wharton School of the University of Pennsylvania. Working paper No. 798. Available at: http://realestate.wharton.upenn.edu/working-papers/urban-accessibility-balancing-land-use-and-transportation/

Duranton, G. and Puga, D. (2001). Nursery Cities: Urban Diversity, Process Innovation, and the Life Cycle of Products. American Economic Review, 91(5), 1454-77.

Duranton, G. and Puga, D. (2004). Micro-foundations of Urban Agglomeration Economies. *Handbook of Regional and Urban Economics*, 4, 2063-17.

Duranton, G. and Puga, D. (2014). The Growth of Cities. In Philippe A. and Durlauf S. (eds.), Handbook of Economic Growth, 2, 781-853. Amsterdam: Elsevier.

Duranton, G. and Puga, D. (2015). Urban Land Use. In Duranton, G., Henderson, J. V. and Strange, W. (eds.),

Handbook of Regional and Urban Economics, 5(8), 467-560. Amsterdam: Elsevier.

Duranton, G. and Turner, M. A. (2011). The Fundamental Law of Road Congestion: Evidence from US Cities. *American Economic Review*, 101(6), 2616-52.

Duranton, G. and Turner, M. A. (2012). Urban Growth and Transportation. *The Review of Economic Studies*, 79(4), 1407-40.

Eeckhout, J. (2004). Gibrat's Law for (All) Cities. *American Economic Review*, 94(5), 1429-51.

Elvidge, C. D., Cinzano, P., Pettit, D. R., Arvesen, J., Sutton, P., Small, C., … and Ebener, S. (2007). The Nightsat Mission Concept. *International Journal of Remote Sensing*, 28(12), 2645-70.

Elvidge, C. D., Ziskin, D., Baugh, K. E., Tuttle, B. T., Tilotamma, G., Pack, D. W., … and Zhizhin, M. (2009). A Fifteen Year Record of Global Natural Gas Flaring Derived from Satellite Data. Energies, 2(3), 595-622.

Eriksen, M. D. and Rosenthal, S. S. (2010). Crowd Out Effects of Place-Based Subsidized Rental Housing: New Evidence from the LIHTC Program. Journal of Public Economics, 94(11), 953-66.

European Commission (2013). Standard Eurobarometer 80. Public opinion surveys in countries of the European Union. Data available at: http://data.europa.eu/euodp/en/data/dataset/S1123_80_1_STD80

Eva, H. D., Belward, A. S., De Miranda, E. E., Di Bella, C. M., Gond, V., Huber, O., … and Fritz, S. (2004). A Land Cover Map of South America. Global Change Biology, 10(5), 731-44.

Feler, L. and Henderson, J. V. (2011). Exclusionary Policies in Urban Development: Under-servicing Migrant Households in Brazilian Cities. Journal of Urban Economics, 69(3), 253-72.

Ferraz, C. and Finan, F. (2008). Exposing Corrupt Politicians: The Effects of Brazil's Publicly Released Audits on Electoral Outcomes. The Quarterly Journal of Economics, 123(2), 703-45.

Field, E. (2003). *Fertility Responses to Urban Land Titling Programs: The Roles of Ownership Security and the Distribution of Household Assets.* Harvard University. Unpublished paper. Available at: https://scholar.harvard.edu/files/field/files/field_fertility_05.pdf

Field, E. (2005). Property Rights and Investment in Urban Slums. *Journal of the European Economic Association*, 3, 279-90.

Field, E. (2007). Entitled to Work: Urban Property Rights and Labor Supply in Peru. *The Quarterly Journal of Economics*, 122(4), 1561-1602.

Fischel, W. A. (1980). Zoning and the Exercise of Monopoly Power: A Reevaluation. *Journal of Urban Economics*, 8(3), 283-93.

Fischel, W. A. (1985). *The Economics of Zoning Laws: A Property Rights Approach to American Land Use Controls*. Baltimore, USA: Johns Hopkins University Press.

Fischel, W. A. (2001). *The Homevoter Hypothesis: How Home Values Influence Local Government Taxation, School Finance, and Land-Use Policies*. Cambridge, USA: Harvard University Press.

Fujita, M. (1989). *Urban Economic Theory: Land Use and City Size*. USA: Cambridge University Press.

Fujita, M. and Thisse, J.-F. (2013). *Economics of Agglomeration: Cities, Industrial Location, and Globalization* (2nd ed.). USA: Cambridge University Press.

Gabaix, X. (1999a). Zipf's Law and the Growth of Cities. *American Economic Review*, 89(2), 129-32.

Gabaix, X. (1999b). Zipf's Law for Cities: An Explanation. *The Quarterly Journal of Economics*, 114(3), 739-67.

Gabaix, X. and Ibragimov, R. (2011). Rank– 1/2: A Simple Way to Improve the OLS Estimation of Tail Exponents. *Journal of Business & Economic Statistics*, 29(1), 24-39.

Galiani, S., Gertler, P., Cooper, R., Martínez, S., Ross, A. and Undurraga, R. (2014). *Shelter from the Storm: Upgrading Housing Infrastructure in Latin American Slums.* IDB. Working paper No. 528.

Galiani, S. and Schargrodsky, E. (2010). Property Rights for the Poor: Effects of Land Titling. *Journal of Public Economics,* 94(9-10), 700-29.

Galiani, S. and Schargrodsky, E. (2016). *The Deregularization of Land Titles.* NBER. Working paper No. 22482.

Gallego, J. M. and Ramírez, M. (2012). Recommendation report on household payment capacity in Colombian cities. Urban Development Division, National Planning Department of Colombia.

Gallego, F., Montero, J-P. and Salas, C. (2013). The Effect of Transport Policies on Car Use: Evidence from Latin American Cities. Journal of Public Economics, 107, 47-62.

García-López, M. Á. and Moreno-Monroy, A. I. (2016). *Income Segregation and Urban Spatial Structure: Evidence from Brazil*. CAF. Working paper No. 2016/08.

Garrido, N. and Vargas, M. (2016). *High-skilled Workers' Segregation and Productivity in Latin American Cities*. CAF. Working paper No. 2016/20.

Glaeser, E. L. (2011). *Triumph of the City: How Our Greatest Invention Makes Us Richer, Smarter, Greener, Healthier, and Happier*. London: Penguin Books Ltd.

Glaeser, E. L. (2014). A World of Cities: The Causes and Consequences of Urbanization in Poorer Countries. *Journal of the European Economic Association*, 12(5), 1154-99.

Glaeser, E. L. and Gyourko, J. (2003). The Impact of Building Restrictions on Housing Affordability. Economic Policy Review, 9(2), 21-39.

Glaeser, E. L. and Gyourko, J. (2008). *Rethinking Federal Housing Policy: How to Make Housing Plentiful and Affordable.* Washington, DC: AEI Press.

Glaeser, E. L. and Kahn, M. E. (2004). Sprawl and Urban Growth. In Henderson, J. V. and Thisse, J.-F. (eds.). *Handbook of Regional and Urban Economics*, 4(56), 2481-527.

Glaeser, E. L., Kahn, M. E. and Rappaport, J. (2008). Why do the Poor Live in Cities? The Role of Public Transportation. Journal of Urban Economics, 63(1), 1-24.

Glaeser, E. L. and Sacerdote, B. (1999). Why Is There More Crime in Cities? *Journal of Political Economy*, 107(S6), S225-S258.

Glaeser, E. L. and Shapiro, J. M. (2002). Cities and Warfare: The Impact of Terrorism on Urban Form. *Journal of Urban Economics*, 51(2), 205-24.

Goldblatt, R., Hanson, G., Heilmann, K. and Khandelwal, A. (2016). *What's the Matter with Nightlights?* Unpublished paper. Retrieved from: http://econweb.ucsd.edu/~kheilman/pdfs/landsat.pdf

Gollin, D., Jedwab, R. and Vollrath, D. (2016). Urbanization with and without Industrialization. Journal of Economic Growth, 21(1), 35-70.

González-Navarro, M. and Quintana-Domeque, C. (2016). Paving Streets for the Poor: Experimental Analysis of Infrastructure Effects. *The Review of Economics and Statistics*, 98(2), 254-67.

Goodwin, P. B. (1992). A Review of New Demand Elasticities with Special Reference to Short and Long Run Effects of Price Changes. *Journal of Transport Economics and Policy*, 26(2), 155-69.

Google Earth (2017). Software program that enables viewing of geographic maps based on satellite images. Data downloaded on April 15, 2017. Available at: https://www.google.com/ intl/es/earth/

Goytia, C. and Dorna, G. (2016). *What is the Role of Urban Growth on Inequality, and Segregation? The Case of Urban Argentina´s Urban Agglomerations*. CAF. Working paper No. 2016/12.

Goytia, C., Dorna, G. and Cohen, J. (2014). *Argentina: propuestas para mejorar la equidad y eficiencia de la distribución espacial de infraestructura*. Unpublished paper.

Goytia, C., Dorna, G., Cohen, J. and Pasquini, R. (2015a). *An Empirical Analysis of Land Use Regulation Determinants*. Lincoln Institute of Land Policy. Working paper No. WP15CG1.

Goytia, C., Dorna, G., Cohen, J. and Pasquini, R. (2015b). *The CIPUV Residential Land Use Regulatory Index: A Measure of the Local Regulatory Environment for Land and Housing Markets in Argentina's Municipalities*. Lincoln Institute of Land Policy. Working paper No. WP15CG2.

Goytia, C., Dorna, G., Cohen, J. and Pasquini, R. (2016). *Housing Affordability: The Land Use Regulation link to Informal Tenure in Developing Countries.* Lincoln Institute of Land Policy. Working paper.

Goytia, C., Pasquini, R. and Hagedorn, T. (2010). Regulación del uso del suelo en municipios argentinos. Reporte de resultados de la Encuesta Nacional 2009. Secretariat of Municipal Affairs of the Ministry of the Interior of Argentina, Universidad Torcuato Di Tella, Lincoln Institute of Land Policy. Retrieved from: http://www.mininterior.gov.ar/prensa/Publicaciones/asuntosMunicipales/Regulaci%C3%B3n%20uso%20de%20Suelo%20Municipios%20Argentina%202009.pdf

Goytia, C., Pasquini, R. and Hagedorn, T. (2012). *Land Use Regulation and Practices in Argentina: 2011 Survey Results*. Lincoln Institute of Land Policy. Working paper No. 101.

Graff Zivin, J. and Neidell, M. (2013). Environment, Health, and Human Capital. *Journal of Economic Literature*, 51(3), 689-730.

Greenstone, M. and Hanna, R. (2014). Environmental Regulations, Air and Water Pollution, and Infant Mortality in India. American Economic Review, 104(10), 3038-72.

Gyourko, J., Saiz, A. and Summers, A. (2008). A New Measure of the Local Regulatory Environment for Housing Markets: The Wharton Residential Land Use Regulatory Index. Urban Studies, 45(3), 693-729.

Handy, S. (2002*). Accessibility- Vs. Mobility-enhancing Strategies for Addressing Automobile Dependence in the U.S*. Department of Environmental Science and Policy, UC Davis. Research report prepared for the European Conference of Ministers of Transport held in May 2002.

Hanna, R., Duflo, E. and Greenstone, M. (2012). *Up in Smoke: The Influence of Household Behavior on the Long-Run Impact of Improved Cooking Stoves*. NBER. Working paper No. 18033.

Hanna, R. and Oliva, P. (2015). The Effect of Pollution on Labor Supply: Evidence from a Natural Experiment in Mexico City. Journal of Public Economics, 122, 68-79.

Henderson, J. V. (1974). The Sizes and Types of Cities. *American Economic Review*, 64(4), 640-56.

Henderson, J. V. (2002). Urban Primacy, External Costs, and Quality of Life. *Resource and Energy Economics*, 24(1), 95-106.

Henderson, J. V. and Mitra, A. (1996). The New Urban Landscape: Developers and Edge Cities. *Regional Science and Urban Economics*, 26(6), 613-43.

Henderson, J. V., Storeygard, A. and Weil, D. (2012). Measuring Economic Growth from Outer Space. *American Economic Review*, 102(2), 994-1028.

Henderson, J. V., Venables, A. J., Regan, T. and Samsonov, I. (2016). Building Functional Cities. Science, 352(6288), 946-47.

Housing Finance Information Network (HOFINET, 2017). Global information on housing finance. Data downloaded on March 8, 2017. Available at: http://www.hofinet.org/documents/index.aspx

Hsu, F. C., Baugh, K. E., Ghosh, T., Zhizhin, M. and Elvidge, C. D. (2015). DMSP-OLS Radiance Calibrated Nighttime Lights Time Series with Intercalibration. Remote Sensing, 7(2), 1855-76.

Huang, X., Schneider, A. and Friedl, M. A. (2016). Mapping Sub-pixel Urban Expansion in China Using MODIS and DMSP/OLS Nighttime Lights. Remote Sensing of Environment, 175, 92-108.

Ibero American Road Safety Observatory (OISEVI) (2016). *VII Informe Iberoamericano de Seguridad Vial 2015-16.* Available at: http://www.oisevi.org/a/images/files/informes/info-7.pdf

Imai, H. (1982). CBD Hypothesis and Economies of Agglomeration. *Journal of Economic Theory*, 28(2), 275-99.

Inman, R. P. (1995). How to Have a Fiscal Crisis: Lessons from Philadelphia. *American Economic Review*, 85(2), 378-83.

Inter-American Development Bank (IDB, 2012). *Room for Development: Housing Markets in Latin America and the Caribbean*. Bouillon, C. P. (ed.). Washington, DC: IDB. Retrieved from: https://publications.iadb.org/bitstream/handle/11319/3472/Un%20espacio%20para%20el%20desarrollo%3a%20los%20mercados%20de%20vivenda%20en%20America%20Latina%20y%20el%20Caribe.pdf

Inter-American Development Bank (IDB, 2014). Emerging and Sustainable Cities Initiative: Indicators Values 2014. Data available at: http://www.iadb.org/es/temas/ciudades-emergentes- y-sostenibles/iniciativa-ciudades-emergentes-y-sostenibles,6656.html

Jaitman, L. (2015). Urban Infrastructure in Latin America and the Caribbean: Public Policy Priorities. *Latin American Economic Review*, 24(1), 1-57.

Jedwab, R., Christiaensen, L. and Gindelsky, M. (2017). Demography, Urbanization and Development: Rural Push, Urban Pull and… Urban Push? Journal of Urban Economics, 98, 6-16.

Jedwab, R. and Vollrath, D. (2015). Urbanization without Growth in Historical Perspective. *Explorations in Economic History*, 58, 1-21.

Jedwab, R. and Vollrath, D. (2017). *The Urban Mortality Transition and Poor Country Urbanization.* Unpublished paper. Retrieved from: https://growthecon.com/assets/Jedwab_Vollrath_Web.pdf

Kim, Y. and Bruckner, T. A. (2016). Political Fragmentation and Widening Disparities in African-American and White Mortality, 1972-1988. SSM - Population Health, 2, 399-406.

Kim, Y. and Zangerling, B. (eds.) (2016). *Mexico Urbanization Review: Managing Spatial Growth for Productive and Livable Cities in Mexico*. Washington, DC: World Bank. Available at: https://openknowledge. worldbank.org/handle/10986/24930

Krugman, P. and Elizondo, R. L. (1996). Trade Policy and the Third World Metropolis. *Journal of Development Economics*, 49(1), 137-50.

Kuznets, S. (1968). *Toward a Theory of Economic Growth*. New York: W. W. Norton & Company.

Lacabana, M. (2017). *Estudio cualitativo de asentamientos urbanos en Buenos Aires*. CAF. Unpublished paper.

Lakner, C., Lugo, M. A., Puig, J., Salinardi, L. and Viveros, M. (2016). *The Incidence of Subsidies to Residential Public Services in Argentina: The Subsidy System in 2014 and Some Alternatives*. World Bank. Working paper No. 7. CEDLAS. Working paper No. 201.

Lanfranchi, G. and Bidart, M. (2016). *Gobernanza metropolitana en América Latina y el Caribe*. Center for Implementation of Public Policies Promoting Equity and Growth (CIPPEC) Working paper No. 151.

Latinobarómetro (2013). Public opinion studies in 18 Latin American countries. Database available at: http://www.latinobarometro.org

Leape, J. (2006). The London Congestion Charge*. Journal of Economic Perspectives*, 20(4), 157-76.

Lefèvre, C. (2008). Democratic Governability of Metropolitan Areas: International Experiences and Lessons for Latin American Cities. In Rojas, E., Cuadrado-Roura, J. and Fernández Güell, J. M. (eds.), Governing the Metropolis: Principles and Cases (pp. 137-92). Inter-American Development Bank and David Rockefeller Center for Latin American Studies, Harvard University. Washington, DC: IDB.

Levinson, D. (2012). Network Structure and City Size. Plos one, 7(1), e29721.

Leyva, S. (2010). El proceso de construcción de estatalidad local (1998-2009): ¿La clave para entender el cambio en Medellín? *Medellín. Medio ambiente, urbanismo, sociedad,* 271-93.

Litman, T. (2003). Measuring Transportation: Traffic, Mobility and Accessibility. ITE Journal, 73(10), 28-32.

Litman, T. (2004). Transit Price Elasticities and Cross-Elasticities. Journal of Public Transportation, 7(2), 37-58.

Liu, Z., He, C., Zhang, Q., Huang, Q. and Yang, Y. (2012). Extracting the Dynamics of Urban Expansion in China Using DMSP-OLS Nighttime Light Data from 1992 to 2008. Landscape and Urban Planning, 106(1), 62-72.

Lowe, M. (2014). *Night Light and ArcGIS: A Brief Guide*. MIT. Working paper. Retrieved from: http://economics.mit.edu/files/8945

Lucas, R. E. and Rossi-Hansberg, E. (2002). On the Internal Structure of Cities. Econometrica, 70(4), 1445-76.

Margo, R. A. (1992). Explaining the Postwar Suburbanization of Population in the United States: The Role of Income. Journal of Urban Economics, 31(3), 301-10.

Marx, B., Stoker, T. and Suri, T. (2013). The Economics of Slums in the Developing World. *Journal of Economic Perspectives*, 27(4), 187-210.

Maurice, N. and Braun, C. (2005). La intercomunalidad: CODENOBA, un logro argentino. *Colección: Políticas sociales /11*. París: UNESCO.

McCollom, B. E. and Pratt, R. H. (2004). Transit Pricing and Fares. In *Traveler Response to Transportation System Changes Handbook* (3rd edition, cap. 12). Serie Transit Cooperative Research Program Report 95. Washington, DC: Transportation Research Board.

McTarnaghan, S., Martín, C., Srini, T. and Collazos, J. (2016). *Literature Review of Housing in Latin America and the Caribbean: Phase I: Global Housing Research Initiative.* Washington, DC: Urban Institute.

McKinsey Global Institute (MGI, 2011). *Urban World: Mapping the Economic Power of Cities*. Retrieved from: http://www.mckinsey.com/global-themes/urbanization/urban-world-mapping-the-economic-power-of-cities

McKinsey Global Institute (MGI, 2012). *Urban America: US Cities in the Global Economy*. Retrieved from: http://www.mckinsey.com/global-themes/urbanization/us-cities-in-the-global-economy

Mexican Competitiveness Institute (IMCO, 2010). Índice de competitividad urbana 2010. Acciones urgentes para las ciudades del futuro. Retrieved from: http://imco.org.mx/ciudades2010/librocompleto.pdf

Michalopoulos, S. and Papaioannou, E. (2013). Pre-colonial Ethnic Institutions and Contemporary African Development. Econometrica, 81(1), 113-52.

Mills, E. S. (1967). An Aggregative Model of Resource Allocation in a Metropolitan Area. American Economic Review, 57(2), 197-210.

Mills, E. S. (2002). Government Urban Growth Controls. *International Real Estate Review*, 5(1), 1-11.

Ministry of Economy of the Province of Buenos Aires Statistics Office (DPE, 2016). Gross domestic product data downloaded in December 2016. Available at: http://www.estadistica.ec.gba.gov.ar/dpe/index.php/economia/cuentas-provinciales/producto-bruto- geografico/95-metodologia-pbg/80-cuad-est-pbg-y-val-agregado

Ministry of Social Development (Sedesol), the National Population Council (CONAPO), and the National Institute of Statistics and Geography (INEGI) (2012). Boundaries of Mexican metropolitan areas 2010. Retrieved from: https://www.gob.mx/cms/uploads/attachment/file/112786/1_DZM_2010_PAG_1-34.pdf

Ministry of Transport of Argentina (2010). *Household Mobility Survey 2009-10: Mobility in the Metropolitan Area of Buenos Aires.* Buenos Aires, Argentina: Urban Transport Project for Metropolitan Areas. Available at: http://uecmovilidad.gob.ar/download/emd-amba-2009-2010/

Municipality of the Metropolitan District of Quito (2016). Economic and industry situation report for the Metropolitan District of Quito. Strategic appraisal - economic aspect. Retrieved from http://gobiernoabierto.quito.gob.ec/wp- content/uploads/documentos/pdf/

Muth, R. F. (1969). *Cities and Housing: The Spatial Pattern of Urban Residential Land Use*. USA: University of Chicago Press.

Muzzini, E., Eraso Puig, B., Anapolsky, S., Lonnberg, T. and Mora, V. (2016). Leveraging the Potential of Argentine Cities: A Framework for Policy Action. Washington, DC: World Bank. Available at: https://openknowledge.worldbank.org/handle/10986/24185

National Administrative Department of Statistics (DANE, 2001). Continuous Household Study. Data downloaded on April 15, 2017. Available at: http://formularios.dane.gov.co/Anda_4_1/ index.php/catalog/185

National Administrative Department of Statistics (DANE, 2005). Housing deficit - 2005. Data downloaded on January 15, 2017. Available at: http://www.dane.gov.co/index.php/estadisticas- por-tema/pobreza-y-condiciones-de-vida/deficit-de-vivienda

National Administrative Department of Statistics (DANE, 2014). Great Integrated Household Survey (GEIH). Data downloaded on April 15, 2017. Available at: http://formularios.dane.gov. co/Anda_4_1/index.php/catalog/328

National Administrative Department of Statistics (DANE, 2014). National quarterly accounts. Gross Domestic Product (GDP). Quarters I, II and III, 2013. Press bulletin 2013. Bogotá. Available at https://www.dane.gov.co/index.php/estadisticas-por-tema/cuentas-nacionales/cuentas-nacionales- trimestrales/historicos-producto-interno-bruto-pib

National Administrative Department of Statistics (DANE, 2016). Construction License Statistics (ELIC). Data downloaded on January 30, 2017. Available at: http://www.dane.gov. co/index.php/estadisticas-por-tema/construccion/licencias-de-construccion

National Administrative Department of Statistics (DANE, 2016). National, departmental and municipal estimates and total population projections by area 1985-2020. Data downloaded on January 30, 2017. Available at: https:// www.dane.gov.co/index.php/estadisticas-por-tema/demografia- y-poblacion/proyecciones-de-poblacion

National Administrative Department of Statistics (DANE, 2016). New Housing Price Index (IPVN). Data downloaded on January 30, 2017. Available at: http://www.dane.gov.co/ index.php/estadisticas-por-tema/construccion/indice-de-precios-de-vivienda-nueva-ipvn

National Institute of Statistics and Census (INDEC, 2010). National Population, Households and Dwellings Census 2010 Redatam Database. Available at: http://www.indec.gov.ar/bases-de-datos.asp

National Institute of Statistics and Census (INDEC, 2015). *Encuesta permanente de hogares. Dominios de estimación y diseño muestral en la Encuesta Permanente de Hogares* (1st ed.). Digital book.

National Statistics Institute (INE, 2016) Departmental gross domestic product data for Bolivia, downloaded in December 2016. Available at: http://web1.ine.gob.bo/indice/general. aspx?codigo=40203

National Statistics Institute of Uruguay (INE, 2016). Square meter price of real estate, according to original classifications. Data downloaded on January 30, 2016. Available at: http://www.ine. gub.uy/web/guest/ precios-de-construccion-de-viviendas

Navarrete, P. and Navarrete, N. (2016). *Moving "Away" from Opportunities?: Homeownership and Employment*. CAF. Working paper No. 2016/07.

New York City Department of Transportation (2017). New York sidewalk maintenance and repair data as of February 2017. Available at: http://www.nyc.gov/html/dot/ html/infrastructure/sidewalkintro.shtml: http://www.nyc.gov/html/dot/html/infrastructure/sidewalkintro.shtml

O'Clery, N. and Lora, E. (2016). *City Size, Distance and Formal Employment Creation*. CAF. Working paper No. 2016/09. CID at Harvard University. Working paper No. 77.

Oates, W. E. (1981). On Local Finance and the Tiebout Model. *American Economic Review*, 71(2), 93-8.

Organisation for Economic Co-operation and Development (OECD, 2015). Mexico 2015: Transforming Urban Policy and Housing Finance (OECD Urban Policy Reviews). París: OECD.

Organisation for Economic Co-operation and Development (OECD, 2015). Governing the City. París: OECD. DOI: http://dx.doi.org/10.1787/9789264226500-en

Organisation for Economic Co-operation and Development (OECD, 2016). Water Governance in Cities. París: OECD. DOI: http://dx.doi.org/10.1787/9789264251090-en

Organisation for Economic Co-operation and Development (OECD), Economic Commission for Latin America and the Caribbean (ECLAC), Inter-American Center of Tax Administrations (CIAT) and the Inter-American Development Bank (IDB) (2017). Revenue Statistics in Latin America and the Caribbean 2017. París: OECD. DOI: http://dx.doi.org/10.1787/rev_lat_car-2017-en-fr

Ogawa, H. and Fujita, M. (1980). Equilibrium Land Use Patterns in a Nonmonocentric City. *Journal of Regional Science*, 20(4), 455-75.

Oliva, P. (2015). Environmental Regulations and Corruption: Automobile Emissions in Mexico City. Journal of Political Economy, 123(3), 686-724.

Ordóñez-Barba, G., Alegría-Olazábal, T., Mcintosh, C. and Zenteno-Quintero, R. (2013). Alcances e impactos del Programa Hábitat en comunidades pobres urbanas de México. Papeles de población, 19(77), 231-67.

Pan American Health Organization (PAHO, 2016). *Road Safety in the Americas.* Washington, DC: PAHO.

Parry, I. W., Walls, M. and Harrington, W. (2007). Automobile Externalities and Policies. *Journal of Economic Literature*, 45(2), 373-99.

Pérez Valbuena, G. J. and Meisel Roca, A. (2014). Ley de Zipf y de Gibrat para Colombia y sus regiones: 1835-2005. *Revista de Historia Económica-Journal of Iberian and Latin American Economic History*, 32(2), 247-86.

Pham, L. and Linsalata, J. (1991). *Effects of Fare Changes on Bus Ridership*. Washington, DC: American Public Transit Association.

Pojani, D. and Stead, D. (2015). Sustainable Urban Transport in Developing World: Beyond Megacities. Sustainability, 7(6), 7784-805.

Quigley, J. M. (2007). Regulation and Property Values in the United States: The High Cost of Monopoly. In Ingram, G. and Hong Y.-H. (eds.), Land Policies and their Outcomes (pp. 46-66). Cambridge, USA: Lincoln Institute of Land Policy.

Quirós, T. P. and Mehndiratta, S. R. (2015). Accessibility Analysis of Growth Patterns in Buenos Aires, Argentina: Density, Employment, and Spatial Form. *Transportation Research Record: Journal of the Transportation Research Board*, 2512, 101-09.

Redding, S. J. and Turner, M. A. (2015). *Transportation Costs and the Spatial Organization of Economic Activity. In* Duranton, G., Henderson, V. J. and Strange, W. C. (eds.), *Handbook of Regional and Urban* Economics (vol. V). Amsterdam: Elsevier.

Roback, J. (1982). Wages, Rents, and the Quality of Life. *Journal of Political Economy*, 90(6), 1257-78.

Roberts, M., Blankespoor, C., Deuskar, C. and Stewart, B. (2017). *Urbanization and Development: Is Latin America and the Caribbean Different from the Rest of the World?* World Bank. Working paper No. 8019.

Rodríguez, D. A., Santana, M. and Pardo, C. F. (2015). *La motocicleta en América Latina: caracterización de su uso e impactos en la movilidad en cinco ciudades de la región*. Bogotá: CAF.

Rodríguez, D. A. and Targa, F. (2004). Value of Accessibility to Bogotá's Bus Rapid Transit System. Transport Reviews, 24(5), 587-610.

Ronconi, L., Casazza, J., Monkkonen, P. and Reese, E. (2012). *Análisis de las características del funcionamiento del mercado de suelo en tres ciudades de la Argentina: Buenos Aires, Córdoba and Rosario.* Center for Implementation of Public Policies Promoting Equity and Growth (CIPPEC) Working paper.

Rosen, S. (1979). Wage-based Indexes of Urban Quality of Life. In Mieszkowski, P. and Straszheim, M. (eds.), Current Issues in Urban Economics. Baltimore, USA: Johns Hopkins University Press.

Rosenthal, S. S. and Strange, W. C. (2004). Evidence on the Nature and Sources of Agglomeration Economies. *Handbook of Regional and Urban Economics*, 4, 2119-71.

Roser, M. (2017). Economic Growth. Online article published at: OurWorldInData.org. Online resource retrieved from: https://ourworldindata.org/economic-growth

Rossi-Hansberg, E., Sarte, P.-D. and Owens, R. (2010). Housing Externalities. *Journal of Political Economy*, 118(3), 485-535.

Salvatore, M., Pozzi, F., Ataman, E., Huddleston, B. and Bloise, M. (2005). *Mapping Global Urban and Rural Population Distributions*. FAO. Working paper No. 24.

Schafer, A. (2000). Regularities in Travel Demand: An International Perspective. *Journal of Transportation and Statistics*, 3(3), 1-31.

Silva, E. and Vaggione, P. (2016). Políticas pro-inclusión. Herramientas prácticas para el desarrollo integral de las ciudades en América Latina. Bogotá: CAF. Available at: http://scioteca.caf.com/ handle/123456789/935

Small, K. A. and Gómez-Ibáñez, J. A. (1999). Urban transportation. *Handbook of Regional and Urban Economics*, 3, 1937-99.

Smolka, M. O. (2013). *Implementing Value Capture in Latin America: Policies and Tools for Urban Development*. Cambridge, USA: Lincoln Institute of Land Policy.

Soares, F. and Soares, Y. S. (2005). *The Socio-Economic Impact of Favela- Bairro: What do the Data Say?* IDB. OVE Working Papers No. 0805.

Soo, K. T. (2014). Zipf, Gibrat and Geography: Evidence from China, India and Brazil. *Papers in Regional Science*, 93(1), 159-81.

Statistical Office of the European Union (Eurostat). (2017). Housing statistics. Data downloaded on April 20, 2017. Available at: http://ec.europa.eu/eurostat/statistics-explained/index.php/ Housing_statistics#Database

Stoloff, J. A. (2004). A Brief History of Public Housing. Presentation at the annual meeting of the American Sociological Association in San Francisco, California, USA. Available at: http://www. allacademic.com/ meta/p108852_index.html

Storeygard, A. (2016). Farther on Down the Road: Transport Costs, Trade and Urban Growth in sub-Saharan Africa. The Review of Economic Studies, 83(3), 1263-95.

Techo (2016). Surveys in slums. Database available at: http://www. techo.org/catastros/

Tiebout, C. M. (1956). A Pure Theory of Local Expenditures. *Journal of Political Economy*, 64(5), 416-24.

Timmins, C. (2006). Estimating Spatial Differences in the Brazilian Cost of Living with Household Location Choices. Journal of Development Economics, 80(1), 59-83.

Tirachini, A. and Quiroz, M. (2016). *Evasión del pago en transporte público: evidencia internacional y lecciones para Santiago*. Department of Civil Engineering, Universidad de Chile. Working paper. DOI: http://dx.doi.org/10.13140/RG.2.1.4212.8884

Touchton, M. and Wampler, B. (2014). Improving Social Well-Being Through New Democratic Institutions. *Comparative Political Studies*, 47(10), 1442-69.

Turner, M. A. (2005). Landscape Preferences and Patterns of Residential Development. *Journal of Urban Economics*, 57(1), 19-54.

United Nations Human Settlements Programme (UN-Habitat, 2013). *Planning and Design for Sustainable Urban Mobility: Global Report on Human Settlements 2013*. Retrieved from: https://unhabitat.org/planning-and-design-for-sustainable-urban-mobility-global-report-on-human-settlements-2013/

US Census Bureau (USCB, 2010). Population Census. Data corresponding to the year 2000, downloaded in April 2017. Available at: https://www.census.gov/ population/www/cen2010/glance/

US Census Bureau (USCB, 2017). United States population data obtained in February 2017. Available at: https://www.census.gov/popclock/

US Congressional Budget Office (CBO, 2008). *Effects of Gasoline Prices on Driving Behavior and Vehicle Markets*. Washington, DC: CBO.

US Geological Survey – National Aeronautics and Space Administration (USGS-NASA, 2010). Landsat 8. Data downloaded in January 2017. Available at: https://earthexplorer.usgs.gov/

Vasconcellos, E. A. (2010). *Análisis de la movilidad urbana. Espacio, medio ambiente y equidad*. Bogota: CAF.

Vasconcellos, E. A. and Mendonça, A. (2016). *Urban Mobility Observatory: 2015-16 Report (executive summary)*. Caracas: CAF.

Voith, R. (1999). Does the Federal Tax Treatment of Housing Affect the Pattern of Metropolitan Development? Federal Reserve Bank of Philadelphia, Business Review, March/April 3-16.

Walsh, R. (2007). Endogenous Open Space Amenities in a Locational Equilibrium. *Journal of Urban Economics*, 61(2), 319-44.

Warnock, V. C. and Warnock, F. E. (2008). Markets and Housing Finance. *Journal of Housing Economics,*17(3), 239-51.

Weidmann, N. B. and Schutte, S. (2016). Using Night Light Emissions for the Prediction of Local Wealth. *Journal of Peace Research*, 54(2), 125-40.

Winston, C. (2013). On the Performance of the U.S. Transportation System: Caution Ahead. *Journal of Economic Literature*, 51(3), 773-824.

Winston, C. and Langer, A. (2006). The Effect of Government Highway Spending on Road Users' Congestion Costs. Journal of Urban Economics, 60(3), 463-83.

World Association of the Major Metropolises (Metropolis, 2014). *Comparative Study on Metropolitan Governance: 2014 Report* (1st ed.). Barcelona, Spain: Metropolis.

World Bank (2009). Argentina- Metropolitan Areas Urban Transport Project. World Bank. Initial project appraisal document. Report No. 50467. Retrieved from: http://documents.worldbank.org/ curated/ en/678941467999106021/Argentina-Metropolitan-Areas-Urban-Transport-Project

World Bank (2009). *World Development Report 2009: Reshaping economic geography.* Washington, DC: World Bank. Retrieved from: http://documents.worldbank.org/curated/ en/785111468331213672/ Informe-sobre-el-desarrollo-mundial-2009-una-nueva-geografia-economica

World Bank (2016). *Doing Business 2016: Measuring Regulatory Quality and Efficiency*. Washington, DC: World Bank. DOI: http://dx.doi.org/10.1596/978-1-4648-0667-4

World Bank (2016). *World Development Indicators (WDI)*. Available at: http://databank.worldbank.org/data/

World Health Organization (WHO, 2016). Global Health Observatory Data Repository. Available at http:// www.who.int/gho/database/en/

Wu, J., He, S., Peng, J., Li, W. and Zhong, X. (2013). Intercalibration of DMSP-OLS Night-Time Light Data by the Invariant Region Method. *International Journal of Remote Sensing*, 34(20), 7356-68.

Zhang, Q. and Seto, K. C. (2011). Mapping Urbanization Dynamics at Regional and Global Scales Using Multi-temporal DMSP/OLS Nighttime Light Data. Remote Sensing of Environment, 115(9), 2320-9.

This book was printed
in January 2018
in Bogota, Colombia.
This edition includes
200 copies.

This report seeks to understand the most critical development challenges currently faced by Latin American cities. Special attention is given to the concept of accessibility, that is, the capacity of households and firms to reach the opportunities offered by a city. Accessibility depends on four areas of public policy action, which are closely related to each other: planning and regulation of land use, urban mobility, the performance of the housing market and the existence of mechanisms for metropolitan coordination.

The concept of accessibility draws attention away from the debate on whether cities should be more or less compact. Accessibility can be achieved in different urban layouts, with different sizes and levels of population density. Hence, public policies must focus on increasing access to opportunities. Any efforts made in this regard must consider the fact that Latin American cities will tend to expand due to the process of secular economic development, which leads households to seek larger properties and use cars to a greater extent.

CAF DEVELOPMENT BANK OF LATIN AMERICA

2017 RED Report on Economic Development

www.caf.com