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**Urban Development Governance:
A Proposed Framework to Investigate
Municipal Infrastructure Inequalities in
Chaotic Mexican Cities**

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Abstract

Chaotic cities are characterized for having inadequate infrastructure and its urban layout lacks of long-term perspective. These cities present stark infrastructure inequalities between rich and poor residential areas. This research attempts to answer this question by using a novel dataset to create an infrastructure inequality measurement. A theoretical framework is introduced to make sense of the difference in infrastructure in cities from the global south. A governance approach is developed to explain why people, economic and housing influxes conditional to the quality of the local governance could inhibit or promote urban infrastructure inequality. The evidence in Mexico seems to support the notion that local governance matters in governing the influxes of people, money and houses, although a number of caveats are identified and requires greater attention in order to confirm these initial results.

Keywords: Urban Governance; Infrastructure; Inequality; Local Government

Resumen

Las ciudades caóticas se caracterizan por tener una infraestructura inadecuada y su diseño urbano carece de perspectiva a largo plazo. Esta investigación intenta explicar el caos urbano utilizando un nuevo conjunto de datos para crear una medición de desigualdad de infraestructura. Se introduce un marco teórico para dar sentido a la diferencia en infraestructura en las ciudades del sur global. Se desarrolla un enfoque de gobernanza para explicar por qué las personas, los influjos económicos y de vivienda, condicionados a la calidad de la gobernanza local afectan la desigualdad de la infraestructura urbana. La evidencia en México parece respaldar la noción de que la gobernanza es importante para gobernar las afluencias de personas, dinero y casas, aunque se identifican varias advertencias y requieren mayor atención para confirmar estos resultados iniciales.

Palabras claves: Gobernanza urbana; Infraestructura; Desigualdad; Gobierno Local

Introducción¹

The way a city grows largely depends on the flux of people and investments. Chaotic or well organized cities depend on the effect of such movements but this are conditional to other aspects that govern such fluxes. In exploring these differences, this paper's prime motive is to answer what can explain the chaos of major cities in the global south? The literature is abundant in offering explanations of city growth tracking back globalized flux of capital and labor. And while there is plenty of evidence to back this theory, there is little research that focuses on the urban governance as the intermediate explanation of chaotic growth characterized of urban infrastructure inequality within cities.

The present investigation tries to answer the question of how urban governance mediate the outcome of urban infrastructure inequality frequently ascribed to the globalized and accelerated flux of people and businesses. While attempting to answer this question, a couple of gaps are hopefully being identified in the literature and partially fulfilled. First, urban inequality has been studied as a socioeconomic condition at an individual level. It is commonly said that inequality lies behind certain urban designs, such as gated communities, as people self-select to mingle "with their own kind" (Cabralas, 2001; R. L. Goix & Vesselinov, 2014; Thibert & Osorio, 2014). The different and perhaps complementary argument is made about social inequality, now

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as a dependent variable which is enhanced by precisely certain urban designs. With few exceptions (see Mcfarlane & Rutherford, 2008) inequality as a matter of systematic infrastructure distribution failure has not been a matter of study. Investigation exists on water provision inequality (Moss, 2008), public services (Mcfarlane, 2008), among others but a general and systematic view of inequality along the urban fabric is still something deserving greater attention.

This research sees inequality as a problem of infrastructure within cities. Chaotic cities or cities in crises are those badly organized, lacking a long term urban planning that very quickly in time get caught by population pressures and therefore are not only unable to provide basic public goods and services to their inhabitants but even worse, because of the inappropriate financial and institutional arrangements, resources get systematically diverted away from equality, producing patches of wealth –or poverty– along a disconnected urban fabric in the city.

Common explanations of urban infrastructure failures have jumped from international- macro level factors directly to explain city buildings, dwellings, streets, etc. This research acknowledges the role and configuration of prevalent urban governance to explain how cities arrive to such chaotic landscape. I therefore review and formulate an urban governance theoretical lens to understand why infrastructure inequality occur. I derived some hypothesis in order to test them along two different stages, which I will soon explain. When bringing the notion of urban governance to the table it does not deny previous knowledge about globalization impacts, but that governances itself could have inhibited or promoted inequality infrastructure within cities (Burgers & Musterd, 2002). Studies around urban governance have arise since late 90's, being American and European cities its main focus. So while not a new approach to urban affairs, its application to the global south and to understand infrastructure inequality yields interesting remarks. Perhaps those needed to promote the theory in crossing a few more frontiers.

I present the Mexican case, but the literature about the global south provides many examples of these kinds of inequality. I refer to the global south as the group of cities in Latin America, Africa, Southeast Asia and India (Graham, 2009) with rapid trends of urbanization and metropolization. These cities, its estimated, accrue an

overwhelming portion of the wealth and they represent almost 70% of the entire population (Graham, 2009). Cities are needed for economic development, technology production, they are in many ways the most efficient social conglomerates (Glaeser, 2014) however it is also true that cities and its problems are becoming state-nations' priorities as these social configurations are about to consume, as the are, huge portions of nations' resources and will be even worse if urban inequality issues are not properly address in the near future.

The research design is composed of an exploratory analysis. After deriving a group of hypothesis, it was clear that the relevant data was not available to test them. However, the governance model proposed hopefully opens an interesting and rich story which is difficult to assess in one place.

INFRASTRUCTURE INEQUALITIES IN CHAOTIC CITIES

Inequality in urban areas have been studied mostly as a human phenomenon. Socioeconomic segregation is the main focus. These literature assessed pattern of human segregation due to links between housing and finance policies (Harner, Jiménez Huerta, & Curz Solís, 2009; Monkkonen, 2012), housing patterns such as the ones seen in gated-communities (R. Le Goix, 2005; R. Le Goix & Vesselinov, 2013), racial segregation (Williams, 2004), and infrastructure that produces inequality (Crump, 2002). Among other references, human characteristics are the most seen in the literature of urban inequality. A premise commonly shared is the importance of urban infrastructure in the resulting human segregation.

Urban inequalities seen from the urban infrastructure perspective yields a new way to assess the political dimension of what is commonly seen as a neutral or ideology-free process of city building and urban planning (Mcfarlane & Rutherford, 2008).

This piece of research focuses the attention to urban infrastructure inequalities. Cities in the global south are undertaking an accelerated rate of influx seen in terms of human population and economic activities. Burgers and Musterd, (2002) concede that economic restructure affect cities human composition whether in terms of social classes as in Sassen's point of view, or in racial composition according to Wilsons theory, and that a three-layer mode of analysis is needed to understand the phenomena.

A global level that observe how globalization has restructured socioeconomic patterns; a national level that serve as an institutional buffer for localities on how these are affected by global trends; and a local sociopolitical history. A similar line of thought in DiGaetano and Strom (2003) inspires how I begin to explore urban infrastructure inequalities. The next section explains how this approach help to understand the inequality infrastructure problem in cities.

WHAT IS BEHIND INFRASTRUCTURE INEQUALITIES? A THEORETICAL FRAMEWORK

Cities' growth largely depends in the flux of people and investments but also important is the way fluxes are governed locally. The literature is abundant in explanations of how cities growth is traced back to globalization on capital and labor forces (Graham, 2009; Mcfarlane & Rutherford, 2008; Moss, 2008). Neoliberalization is a concept used to explain city changes. Growth become chaotic in the global south -as it is referred to cities in developing countries- from years after the end of the cold war to nowadays. However, during that same period, housing policies have changed and so have the urbanization trends, as the available literature concedes. Theories about city changes and more importantly about cities' problems and crises have amassed relevant evidence around mostly external factors, although not necessarily exogenous, affecting cities' trends and trajectories. It leaves a wide open space to investigate other set of factors, perhaps other national and local set of elements that could be signaled as promoters of city chaos. Along these very well documented external factors that impact cities' trajectories, a net of actors and institutions entrenched in a governance mode lies behind, and explains why some cities have greater infrastructure inequality than others.

This piece of research casts some light in the governance that drives the growth of a city. The main argument is that whether a chaotic and unequal city or a well-planned and organized urban fabric, a net of governmental and non-governmental entities plays a role, and together produce an outcome with respect to the equality of the urban infrastructure. Urban governance is the main unit of observation. Definitions vary from normative ones to others that claim we are looking with different eyes something that has been out there for many years (Heinrich, Lynn, & Milward, 2009). A

fundamental premise behind the urban governance definition is that government is not enough to explain policy or its outcomes. Not entirely absent however, government is around as a continuous variable (Pierre, 2005) with a thick state-led development strategy on one side, to a thin-state market-oriented urban development on the other side. Almost all public provision schemes, public-private or coproduction arrangements tend to orbit somewhere in between.

DiGaetano and Strom (2003) talk about an urban governance affected by macro-economic or an international environment followed by a national and mediating institutional layer and thirdly a set of local rational actors driving the final outcome. I will develop a theoretical approach taking into account these three aspects. I begin from the outside-kind factors to a more individualistic or agency-driven explanation around the phenomenon of urban infrastructure inequality. Important to say is the derived hypothesis are not excludable between them. In some cases, it feels the need to integrate them in order to understand what could be the supporting factors around specific mechanisms (Cartwright, 2013). It is difficult to assess ex-ante these relations, however a note in this sense accompany the hypotheses which will serve later for the empirical strategy and further field work.

Macro Political or Economic Environment

For many urban students and geographers, macroeconomic trends have provided a classic explanation for chaotic urban fabric, more precisely, for inequalities within the urban fabric. Globalization and neoliberalism are two concepts frequently used. The idea behind it is the accelerated flux that cities experience in terms of people, migration and segregation and economic activity, investments and industrialization (Thibert & Osorio, 2014; Harner et al., 2009; Posner, 2012), and perhaps a conflicting rationality in terms of values and lifestyle visions behind the formation of cities (Schindler, 2015) or the spatial differentiation promoted by infrastructure managers in line with the splintering urbanization theory (Graham & Marvin 1997). This has been the context of cities in the global south for the last part of 20th century and the new millennium.

The effect of globalization in urban infrastructure inequality is one that can not be explained solely by this macro trend. Mediating factors play a key role, however, such

rapid fluctuations of humans and resources challenge existing sociopolitical and economic configurations imposing new demands on infrastructure, which local authorities and institutions are not capable to address immediately. The result is a lag between infrastructure needs and infrastructure provision that enhance infrastructure inequality affecting most likely the poor.

Effect of Policies and Related Institutions

Factors at the macro level are partially responsible for inequalities, if that is the case. The effect of other policies or the effect of mid-range level institutions need to be taken into account. On the policies side, I refer to those deliberately pursue a direct impact on urban developments. Some of these are designed and financed by upper-tiers levels of government (Kim, 2010). In federal countries such as Brazil, Mexico, US, among others, the literature spots the existence of urban housing programs or housing finance programs directly affecting the urban development (Crump, 2002; Monkkonen, 2012, 2016). Similar programs were seen in non-federal countries, with central governments getting involved in urban developments (Governata & Saccomani, 2009; Thibert & Osorio, 2014).

Urban infrastructure construction is closely related to housing programs or housing developments. Neighborhoods are not livable spaces without at least a minimum set of urban goods such as roads, water and sewer, electricity networks, among others. Private housing developers frequently become the *de facto* infrastructure providers. Public Private Partnerships in many countries become the main provider of public infrastructure (Garvin & Bosso, 2008; Kim, 2010). Once settled, infrastructure becomes the municipalities' responsibility. While housing policies promote urban growth, under certain circumstances such growth become the most fundamental driver of socioeconomic segregation (Monkkonen 2012), and perhaps urban infrastructure inequality as well. The original argument is that large homogenous neighborhoods being built by national-led housing financing programs are likely to exacerbate socioeconomic segregation. If to the latter we add a speculative market approach that looks outer-lands to generate greater commercial margins for private housing developers and who, sometimes, develop buildings and infrastructure with

little regards to natural hazards or conflicting land uses (Harner et al 2009) a plausible outcome is greater infrastructure inequality. The derived hypothesis is that (H1) Massive housing financing programs combined with a weak regulated public-private scheme of infrastructure building can exacerbated infrastructure inequality. Due to the fact that such programs promoted land-price speculation from private sector firms who easily may have overlook quality and quantity of urban infrastructure while assuring the profitability of housing projects.

Policies aimed to promote localities by hosting international events are popular these days. They can also explain infrastructure inequality. It has become a strategy of local governments to bid and host international mega-events such as Olympic Games and many other international sport competitions (Müller, 2015; Sánchez, 2013). In doing so, local authorities take advantage to revamp, renew or construct urban infrastructure and housing developments among others. During the last two mega-events in Brazil, it was estimated a one trillion dollar public and private investment² on urban infrastructure. Londons' 2012 Olympic games also promoted an 11 billion dollar³ investment and the regeneration of East London, a largely neglected part of the city (Davis & Thornley, 2012). Even mid-size international events have a similar effect. The Panamerican games' spillover in Guadalajara 2011 was estimated in around 2.7 billion dollars. State and local governments were set to regenerate and urbanize new urban areas with public and private money which was planned to be sold once the event had passed. Despite the goodness of the investments, the strategically investments made in the renewed environments could foster urban inequality. Municipal efforts, specially in the global south, emphasizing the transformation of urban spaces instead of incorporating a high quality of urban governance to improve "populations" produce urban disconnection (Schindler, 2015) and inequality. The hypothesis here is that (H2) the logic of urban transformation, through renewing environments with megaprojects promoted by a local elite governance, affect urban inequality levels because is

² Infrastructure: Brazil, the World Cup and Olympics
<http://www.americasquarterly.org/Brazil-the-World-Cup-and-Olympics>

³ Olympics legacy: Did the Games succeed in rejuvenating East London?
<http://www.independent.co.uk/sport/olympics/olympics-legacy-did-the-games-succeed-in-rejuvenating-east-london-8711691.html>

impossible to enhance all urban fabric at once with a major and strategically located urban transformation. While some would be positively affected, others would lag behind.

While direct policy affects infrastructure inequality, I here address the effect of other kind of institutions. A lack of governmental control and accountability exacerbates the problem mentioned in the last few arguments. Local policies around the implementation of general urban plans of cities set the tone on informal settlements practices and other modes of private urban developments. Informal settlements are too, important forces driving urbanization and infrastructure inequality. Informal settlements press local governments to urbanize chunks of land but due to the lack of an appropriate legal framework, few financial alternatives are provided both for dwellings and for public infrastructure. Along a weak taxing and financing local system, municipal governments are unable to address these needs, and public-private partnerships are often unwilling to pursue these projects. In the following section, I explain why these general plans could fail. Instead I readdress attention to local governments land planning and management capacity that encourage a positive urbanization cycle enabling rapid urban population growth into greater economic opportunities (Turok & McGranahan, 2013) and avoids diseconomies of scale and density (Turok, 2016), often reached by urbanization policies without regards to future consequences. An hypothesis (H3) here is that local government's lack of capacities towards planning and management of land, often associated to private development practices and informal settlements, exacerbates urban infrastructure inequality.

Issues about urban inequality have been raised with the proliferation of certain modes of private urban developments such as gated communities (Blakely & Snyder 1997; Cabrales, 2001; Le Goix, 2005; Le Goix & Vesselinov, 2013). An obvious argument that links gated communities and infrastructure inequality has to do with private developers' economic interests. These enclosed housing communities where firstly seen to aim high income populations but more recent investigations observe gated housing aiming low income populations as well. While infrastructure quality may be correlated to wealth, there are other less studied mechanisms linking gated communities and infrastructure inequality.

The argument follows the governance innovations in gated communities which are different to those in open-city vicinities (Coyle McCabe, 2011). Open-city neighborhoods directly, and very often at individual basis, deal with government institutions. A typical collective action problem arise when dealing with infrastructure affairs. Open-city vicinities are less prepared to push forward their interests in relation to what gated communities can achieve. On the contrary, Home Owners Associations (HOA) in gated communities partially solves this problem (Coyle McCabe, 2011). These organizations are better in protecting their infrastructure because incentives are in place to protect their property value via infrastructure arrangements. Additionally, an alternative mechanism of urban infrastructure inequality is linked to HOA's power over public officials and policies. There is evidence on the political capacity that home owners' associations (HOA) in gated communities have achieved and used to affect policy-making (Groves 2006). Therefore, a derive hypothesis is that (H4). HOAs behave as members of a club, thus are more likely to solve a collective action problem in terms of their infrastructure affairs and to influence local elected policy decision makers on their interests of infrastructure in comparison to other residents located out of gated communities. Of course a key assumption here is that such governance modes do exists and are capable of working effectively. Appropriate legal frameworks enhance or remove the power of Home Owners Associations (HOA) over constituencies and properties.

Finally, an argument exists around urban political and administrative fragmentation and socioeconomic inequality (Lowery, 2000). Argument against a tiboutian mode of local competition is that such mechanism promote segregation through self-sorting, and fails to reduce intergovernmental inequalities. However, a similar argument applies to infrastructural inequalities due to political and administrative fragmentation. Because urban sprawl in metropolitan areas crosses municipal borders, the same city is subject to different municipality legal frameworks, technical and financial capacities will also have different urban infrastructure providing capacities. While legal frameworks, technical and financial capacities of municipalities are strongly associated to populations' social and economic features, a strict tiboutan mechanism along with greater wealth gaps between populations will not only promote

more social and economic segregation but also local capacities and infrastructure inequality. The hypothesis is that (H5) Political and administrative fragmentation, like the one observed in metropolitan regions, promotes and reinforces inequalities which originally could have been a product of class and race self-sorting.

Actors' Agency Footprint

Rational actors are at the end of the governance chain. Impossible is to separate environments, policies and institutions from agency theories. The purpose of this section is to focus on the agency of actors in explaining how their actions and strategies enhance urban infrastructure inequality. The literature concedes at least three theoretical standpoints.

The first is the well known growth machine politics, originally presented by Logan and Molotch (1987). The premise here is that owners of land have a problem which is they can not move their asset around in search for a better deal. Capital and labor can, and do move around, therefore land owners need to attract these economic factors so their asset reaches greater surplus value. The main idea is that private land owners and government appointees collide and plan the city in ways both parties win. Politicians promote urban developments to attract business and labor, they engage in economic policies and change urban plans partly moved in accordance with land owner interests. In exchange politicians get help from their associates to remain in office or to promote their political careers. The city grows and so politicians' careers. A number of research has provided additional insights both producing evidence in favor (Delgadillo, 2016; Pierre, 1999) or critical to the existence of growth machines (see Kantor & Savitch, 2005). The problem begins when certain areas of the city getting neglected by these redevelopment projects. The hypothesis would be that (H6) in certain cases, local actor coalitions that see the city as a profit-making machine via urban redevelopment projects could make difficult for the low-income population to access and maintain their livelihood in targeted areas. These targeted areas, where private interests grant greater profitability, could remain in good shape but the city government would neglect other areas where private interests are not posited, therefore creating gaps in terms of infrastructure quantity and quality.

A second agency explanation of urban inequality is the clientelistic use of the territory and urban infrastructure. The previous section made reference to this point when dealing with mediating governmental institutions dealing with macro political and economical trends. In many countries, specially in developing ones, clientelism is a frequently used political strategy for electoral purposes. Irregular settlements are spaces where political machines work in getting support. They establish networks and promise to help them achieve the legalization of informal occupied parcels with the local government in exchange of electoral support and mobilization (Siembieda & Moreno, 1997). This is an alternative form of city growth where first irregular livelihoods arise, via clientelistic networks, and later pressure authorities to regulate and provide infrastructure. In the mean time, cities' infrastructure gaps remain between the regular landscapes and the irregular settlements. There is evidence of clientelistic city growth machines in global south (Harner et al., 2009; Mcfarlane & Rutherford, 2008; Satterthwaite, 2003). Therefore, the hypothesis is then that (H7) the presence of political agents who wish to establish a clientelistic network, negotiated land and infrastructure producing irregular settlements with those who are willing to support their parties during elections. These irregular settlements will eventually pressure for public services and infrastructure maintaining a vicious clientelistic cycle enhancing infrastructure inequality.

A final remark on actors' agency footprint is one observed due to different local government institutional configurations. Actors are rational but bounded by institutional configurations and decisions made under different institutions produce infrastructure inequality. This is the case of infrastructure decision made by strong mayors vis a vis city managers. The main argument here is that strong mayors, contrary to city managers, remain closely allied to urban machines and directly establish and administer policy in respond to key political partners or constituencies. Strong mayors use infrastructure spending to respond to economic downturns, to reward political partners (Nunn, 1996) or support clientelistic strategies previous election days (Meza, 2015). An elastic infrastructure policy is expected with a strong mayor, and though strong mayors themselves are not a sufficient condition to predict infrastructure inequality (H8) they do open the way to political use of resources instead of a more

technical appraisal of infrastructure need, increasing chances of an unequal distribution of infrastructure.

EMPIRICAL ASSESSMENT OF INFRASTRUCTURE INEQUALITIES IN MEXICAN CITIES

The following section explains the empirical strategy and the data used to explore the theoretical hypothesis on the field. Because this is a “work in progress document” there are no solid and final conclusions, but what I hope is an interesting exploration that invites further inquiry. I used an interaction linear regression model to analyze the relation between the main dependent variable -urban infrastructure inequality- on other independent variables that serve as proxy for economic and social fluxes and for governments’ capacity. In order to assess the theoretical framework, I used the case of Mexican cities.

Mexican Cities’ Urban Inequality

There is not enough data in Mexico to assess the complete set of hypothesis unveiled in the previous section. However, I derive few basic empirical implications to explore the available data in line with the theoretical framework. Despite limitations with data, the whole set of hypotheses can guide further empirical research along with case studies or other research designs.

In an exploratory mood, I test whether infrastructure distribution is driven by any of the fluxes mentioned in the theoretical framework. I test three kinds of fluxes and the plausible effect of local governance limitations. At the macro level, economic and population fluxes affect the distribution of infrastructure. According to the theoretical framework, in the global south the problem increase when rapid and accelerated fluxes arrive to a place and local governments are not well prepared to govern them. Mid-range policies such as housing policies are said to affect urban infrastructure too. The strength of this influx affect local capacities to govern and arrange the impact of these policies in ways that avoid great infrastructure inequality. The plausible outcome in infrastructure inequality affect throughout any of the following mechanisms stated before, i) because private-public partnership which typically engage in the supply of urban and housing infrastructure enter in a corruption

cycle with local officials, ii) because local governments are not able to set limits or apply punishments to private developers to make them superimpose public values over private interest, iii) because local officials engage in clientelistic strategies with poorer sector of the population frequently inhabiting informal settlements.

The basic model used to analyze the data is an interaction linear regression as the following:

$$Y_i = \alpha + \beta(X_i * Z_i) + \beta K_i + \varepsilon \quad (1)$$

- Y_i is the dependent variable. New data from the Mexican Census is used to produce a measure of infrastructure inequality at a municipal-city level.
- X_i is a vector of independent variables proxying social and economic fluxes.
- Z_i is a vector of variables to which interact the other independent variables. These variables are two 1) local government capacities and 2) initial population level of the municipality.
- K_i is a vector of variables that represent a control for size in population terms, and the interacting variable on its own.

Dependent Variable: Infrastructure Gini Coefficient for Cities

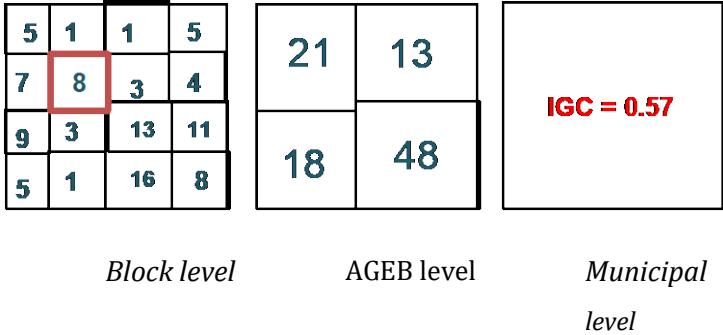
Data to measure urban infrastructure for Mexican cities was impossible until the last census in year 2010. This new data was used to produce an infrastructure inequality indicator at a municipal level. It is basically a Gini coefficient at a municipal-city level that captures urban inequality in terms of its infrastructure. I here show the details and descriptions.

The last National Census Survey (2010), the Mexican NSO -National Statistics Office (INEGI)⁴- included a section that recorded data on urban infrastructure. It asked surveyors to rank the availability or urban infrastructure at a block level. A block is a geographic polygon of buildings enclosed by streets or roads. Surveyors would register the existence of infrastructure elements in a block such as paved roads, sidewalks, trunk trims, ornament plants, street lights, sewer, wheelchair ramps and street signs. For each infrastructure element, a number of 2 is assigned to the block if it was available in all sides of the block, a number of 1 is assigned if the element was only observed in

⁴ INEGI. Instituto Nacional de Estadísticas y Geografía:
(http://www3.inegi.org.mx/sistemas/microdatos/default_urbano.aspx)

some of its sides, and 0 if the infrastructure element was not available at all. The sum of this registries yields a number for a block that measures infrastructure availability. The greater the number, the better the urban infrastructure at that specific block.

Figure. 1. Stylized explanation of the IGC⁵



An urban Infrastructure Gini Coefficient (IGC) was produced using AGEBs’ aggregate information of block-level registries (see figure 1). An AGEB is a sub-municipal polygon devised by INEGI to organize and store many kinds of information. An AGEB is typically greater than a block -many blocks in one AGEB- and so the IGC was made using the AGEB as the main individual level. In that sense, a city with greater infrastructure inequality would be one where few AGEBs accrue a large number of infrastructural elements while many others remain with a lower count. The resulting Gini coefficient is a number between (0,1). The closer to one means greater inequality. In data set used, the mean is xx.

Independent Variables: Fluxes of People, Money and Houses

An accelerated rate of people influx stresses the urban infrastructure. I used the municipal average period rate of population growth from the last 4 census waves -15 years- as a proxy of people influx.⁶ The basic expectation is that a greater average annual rate is associated to greater inequality infrastructure. The mean average period

⁵ The numeric representation is an example.
⁶ A National Census is undertaken by INEGI every 10 years and every 5 years INEGI makes a National Count of population.

rate of population growth in the dataset is 21 percent. The variable is continuous ranging between -0.14 to 2.0

Rapid rates of economic influxes are said to affect urban infrastructure equal distribution. Registries of economic units and economic fixed assets in thousands of Mexican pesos exist at the municipal level. These two registries serve as economic flux proxies. The stronger the flux, the greater the impact in urban infrastructure inequality. Economic units are counted every 5 years, the sum of all economic units in the last 15 years represent the strength of the flux in a given municipality. I use the natural logarithm to smooth the distribution. The mean is 8.4 and the variable is one that ranges between 5.4 to 12.7. The sum of the last 15 years annual fixed assets measured in thousands of Mexican pesos is the second economic flux proxy. I use the natural logarithm as well. The variable dataset mean is 14.13 and it ranges between 9.7 and 21.7.

Table 1. Summary statistics

VARIABLE	N	MEAN	SD	MIN	MAX
INFRASTRUCTURE GINI COEFFICIENT	1124	0.46	0.14	0.00	0.80
LOCAL GOV. INSTITUTIONAL CAPACITY MEASUREMENT (DICOTOMIC VERSION)	1124	1.50	0.50	1.00	2.00
MUNICIPAL POPULATION SIZE (DICOTOMIC)	1124	1.16	0.37	1.00	2.00
AVERAGE PERIOD POPULATION GROWTH (4 PERIODS)	1101	0.059	0.067	-0.268	0.417
NUMBER OF HOUSING CREDITS IN THE LAST 16 YEARS (NL)	1124	9.066	1.417	3.178	13.464
HOUSING INVESTMENTS IN THE LAST 16 YEARS THOUSANDS-MXP (NL)	1124	12.800	2.108	7.691	18.582
NUMBER OF ECONOMIC UNITS REGISTERED IN THE LAST 15 YEARS (NL)	1116	8.429	1.200	5.464	12.700
INVESTMENTS IN FIXED ASSETS IN THE LAST 15 YEARS THOUSANDS-MXP (LN)	1116	14.136	2.082	9.778	21.784
TOTAL MUNICIPAL POPULATION IN 1995	1101	73,901	158,456	3,742	1,696,609
TOTAL MUNICIPAL POPULATION IN 2010	1101	91,789	187,982	5,045	1,815,786

Aggressive federal housing policies may disrupt infrastructure equality distribution in a given city, according to the theoretical framework. Statistics on housing credits and housing investment exist at municipal level. I used the sum of credits and housing investments in thousands of Mexican pesos (natural logarithm) to proxy the impact of these policies. Noteworthy is that the data covers all type of investments and credits and not only the ones channeled through national housing policies. Until the writing of this section, such data was not available. This is an important caveat to bear in mind.

Housing credits (natural logarithm) is a continuous variable that ranges between (3.1, 13.4), the mean is (9). Housing investments is a continuous variable (also natural logarithm) ranging between (7.6, 18.5), the mean is 12.7.

Interacting Variables: Local Governments' Capacity and Initial Size of Population

Impact of fluxes in infrastructure is mediated by nature of the local governance. While there is no data to assess a complete picture of local governance, the proxy I use is local governments' institutional capacity. The institutional capacity measurement of local governments –municipalities- is produced by the Federal Supreme Audit Office in Mexico (FSAO).⁷ In the year 2013, the FSAO produced an institutional capacity to assess local governments in four areas: 1) financial capacity, 2) public service coverage, 3) administrative development, 4) transparency and accountability. The assessment represents the local governance under the premise that the quality of a local government is associated to its capacity to govern the interactions within the urban policy network. This measurement scales between (0,1), and the sample mean is .49, but a dichotomic version was made to interact other variables where 0 = localities with a capacity score below the mean, and 1 = localities with a capacity score above the mean threshold.

RESULTS

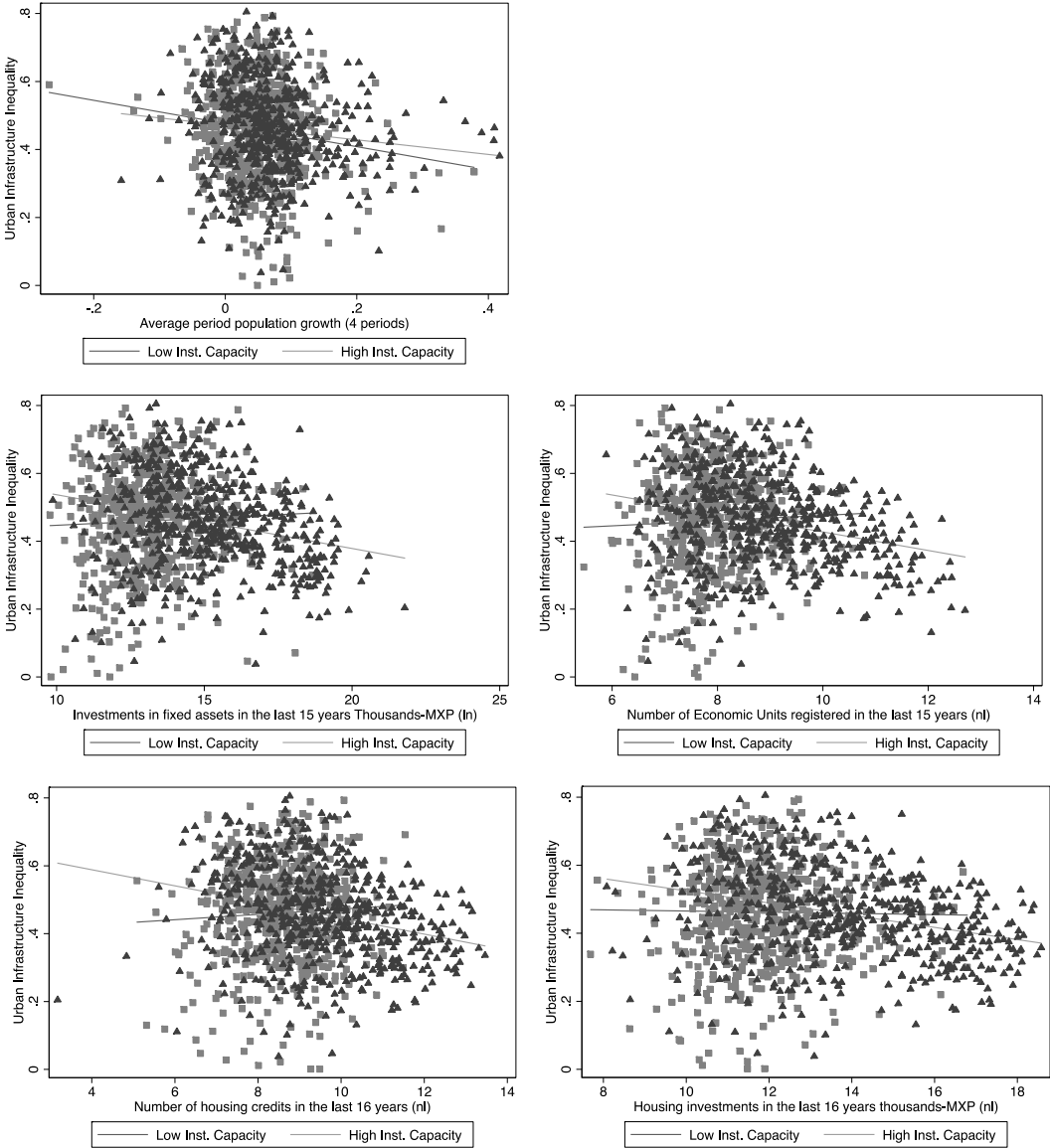
The results clearly suggest a divergent effect of fluxes on infrastructure inequality conditional to local characteristics. Local government capacities play an intermediate role on fluxes of people, money and housing in Mexican cities.

A graphic inspection of the data (see figure 2) suggests that an accelerated rate of influx affects infrastructure inequality, but the effect varies conditional to local governments' capacity. With one exception –population growth-, fluxes of money and houses increase infrastructure inequality when local government is assigned to the lowest spectrum of

⁷ In spanish this entity is called Auditoria Superior de la Federación

the institutional capacity measurement. On the other hand, fluxes decrease infrastructure inequality when institutional capacity rates high.

Figure 2. Divergence conditional to local government’s capacity



Source: Author elaboration

A simple test using an interaction effect regression, partially support the latter claim. This time population growth and economic unit variables are the exception. All other

interaction regressions confirm the divergent effect of fluxes over infrastructure inequality.

Average period population growth shows two statistical significant betas. Both with negative sign. Low institutional capacity has a bigger coefficient than its high capacity counterpart. On the housing variable, the sum of housing credits in the last 15 years has a positive sign when the variable interacts with the low capacity dummy but the coefficient yields no statically significance. Housing credits interacted with high capacity dummy has a negative and statistically significant coefficient. A change from low to a high capacity along a one percent of change in housing credits is associated with a decrease of 1.6 points of the inequality measurement.

Table 2. Interaction regression models

VARIABLES	(1)	(2)	(3)	(4)	(5)
	Infrastructure inequality (Gini Coefficient)				
Local Gov. Institutional Capacity measurement (dicotomic)	0.0102 (0.0114)	0.237*** (0.0658)	0.178*** (0.0650)	0.181** (0.0727)	0.174** (0.0798)
Municipal population size in 2010	-1.50e-07*** (2.34e-08)	-8.94e-08*** (3.14e-08)	-8.11e-08*** (3.06e-08)	-1.20e-07*** (3.09e-08)	-1.16e-07*** (3.66e-08)
Interactions with Local Gov. Institutional Capacity measurement 1 = Low capacity, 2= high capacity					
Average period population growth (4 periods)					
1					
2					
Number of housing credits in the last X years (Ln)					
1					
2					
Housing investments in the last X years MXP (Ln)					
1					
2					
Investments in fixed assets in the last x years MXP (ln)					
1					
2					
Number of Economic Units registered in the last X years (nl)					
1					
2					
Constant	0.471*** (0.0174)	0.154 (0.108)	0.289*** (0.107)	0.212* (0.117)	0.217* (0.129)
Observations	1,101	1,101	1,101	1,101	1,101
R-squared	0.052	0.050	0.050	0.043	0.042
Standard errors in parentheses					
*** p<0.01, ** p<0.05, * p<0.1					

The housing investment variable behave similarly to housing credits. No beta coefficient with the low capacity interaction appears significant although the sign is positive. The high capacity interaction has a negative and significant coefficient. A change from low to high capacity along a one percent change in housing investments is associated with a decrease of 1.2 points in the urban inequality Gini coefficient.

Finally, with economic variables the signs and strength varies. Economic fluxes proxied with investments in fixed assets have a negative and significant beta coefficient when the variable is interacted with high capacity local governments. The coefficient is rather small; the associated change is smaller than 1 point in the Gini measurement. There is no statistically significant coefficient with the variable economic units.

DISCUSSION

The evidence partially supports the theoretical framework. Although the data was not enough to test the whole theoretical framework, the exploratory analysis suggest a partial confirmation of some of its main precepts. I here discuss the evidence and the caveats the analysis has.

The theoretical framework was devised to explain an urban phenomenon in what authors refer to the global south. This is mostly developing countries' cities that have progressively and constantly grew into big and chaotic urban conglomerations. Chaotic cities are characterized with urban inequalities and infrastructure disruptions which are frequently explain due to rapid social and economic inflows. The main argument is that influxes are governed by an urban governance mode that enhance or inhibit urban infrastructure inequality.

It is clear that local governments capacity makes a difference on how fluxes are associated with urban infrastructure developments. The main premise is that the construction of a city requires actions from many other parties rather than those of governments'. The urban governance is this rather large and disperse set of agents that end up building the city which we live in. The analysis assumption is that local governments' capacity represent the quality of the local governance. The institutional capacity variable measures a combination of hard and soft powers such as capacity in

terms of finance, administration, accountability and service provisions. Therefore, the government-governance link rests under the notion that localities capacity to influence other actors are closely associated to its own hard and soft capacities (Stoker, 2011).

An accelerated rate of people immigration stress cities' resource management and availability. Under the lack of local capacity, the predicted outcome is more infrastructure inequality, but the evidence suggests a decrease of inequality at any level of capacity. The associated negative effect is bigger in low capacity governments which raises more questions. It is necessary to control for omitted variables that could drive those results. Imbalances on the stock of infrastructure between the low and high capacity governments could explain the difference. Under the assumption that more population increase economic markets and housing market supply, and the latter increase the urban fabric, then places with a lower stock of infrastructure would marginally benefit more than those with a greater initial infrastructure stock. A smaller coefficient seen in high capacity governments are driven by a higher initial infrastructural stock and therefore lower marginal gains from population inflows.

In line with the theoretical prediction, housing influxes are associated with negative urban inequality only in municipalities with high capacity governments. But there is no statistically significant positive effect associated between housing influxes and lower levels of governments' capacity, which hinders the validation of the idea that federal housing finance is driving infrastructure inequality. The housing variables used in the analysis are not exclusively capturing the effect of federal housing programs but the general stock of housing credits and investments. While a correlation is expected, the data is not clean enough to assess the plausible effect.

Additionally, there is an endogenous effect the analysis is not controlling yet, and this could also explain the results seen with the economic influx variables. Housing and economic influxes could be actually producing greater infrastructure inequality but the model is failing to capture it because a problem of endogeneity. Lower infrastructure inequality, therefore a better governed city, could be attracting more economic and housing projects. This effect is being captured only with the high capacity level dummy but there is no significant association of this link at the low capacity dummy because influxes at this level are not enough and standard deviations are huge.

Finally, there are some issues concerning the dependent variable that measures infrastructure inequality. The measurement of infrastructure inequality is definitely being underestimating the real inequality. The block level count of infrastructure can only capture huge disparities but smaller details can make a huge difference in the way we live a city. Take sidewalks for example, the block count in the Gini coefficient would measure the same disregard the size of sidewalks, even if a narrow sidewalk imposes greater costs to pedestrians than a wider type of sidewalk. Infrastructure inequality is observed in many other subtler differences which the Gini coefficient is imperfectly capturing.

Conclusions

This paper deals with the question of infrastructure inequality in cities from the global south. In my attempt to answer this question I modestly contribute with the literature in three different ways. First, inequality is a subject of ample study with regards to socioeconomic and individual income, it rarely addresses inequality in urban infrastructure. The focus of this research is infrastructure inequality within cities. Second, available inequality's explanations rely on a neoliberal rhetoric which, for example, assigns socioeconomic segregation to the economic system. This paper critically accepts the argument by unveiling the importance of the mediating effect of the local governance in the process of unequal distribution of infrastructure. Thirdly, the existence of measures of infrastructure inequality are difficult for large number of cities. This research design takes advantage of a novel measurement in the Mexican context which enables me to explore the drivers of inequality in Mexican chaotic cities.

With many data limitations, I undertook an exploratory approach to empirically test some of the main points raised in the theoretical framework. These ideas were that rapid population, economic and houses influxes stress city resources and managements capacity that infrastructure provision conforms with an uneven distribution. Local governance capacity would mediate and mitigate the problem.

The results partially support the theory. It is clear that divergent outcomes are seen in cities governed by governments differing in their institutional capacities. The association between economic and houses influxes presented a decrease in the inequality measure when the municipalities had a high capacity type of government. Low capacity governments did not yield significant results although the expected sign was observed. Population influxes seem to have, in general terms, a decreasing associated effect in infrastructure inequality. But a number of caveats make me suspect about the need to perform a deeper analysis of the data.

The exploratory results suggest that the questions deserve greater attention. Perhaps a different investigation strategy would be helpful to uncover the stories behind infrastructure inequality. Stories that may confirm the theoretical notion I have

here proposed, such as the importance of the local governance in the making of cities. Or else, alternative lines of inquiry that have been neglected to understand and explain the chaotic layout of cities in the global south.

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