

CITY GROWTH AND INCOME INEQUALITY

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By

Arturo Villegas Limas, B.S.

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1. Introduction

The world is increasingly urbanized. The United Nations World Urbanization Prospects reported that the urban population grew rapidly; reaching one billion people in 1959, taking 26 years to reach the second billion, another 17 years to reach the third billion and a mere 13 years to reach four billion people. Furthermore, the report stated that the world urban population exceeded the rural population for the first time in 2007 and forecasted that in 2050 the urban population will increase by 2.4 billion people (UN-DESA, 2018). Because of this, urban issues, specifically those related to inequality and poverty, have gained attention in recent years.

Economists have recently argued that poverty rates in urban areas are becoming increasingly abundant. Historically, higher levels of poverty, especially in the developed world, was found in rural areas. However, poverty in cities has increased, and it is estimated that the share of people in poverty living in urbanized areas will reach 50 percent by 2035 (Ravallion, 2002). The share of urbanized poverty changes across regions as well; approximately 10 percent of those in poverty in East Asian countries live in cities while that statistic is much higher in Latin America (Ravallion et al., 2007). The increasing number of low-income households in cities could create an impact on wage disparities in cities, potentially exacerbating them, leading to income imbalances between different groups within an urban population. Higher wages and wealth concentrate in cities significantly more than in rural areas (Glaeser and Gottlieb, 2009), and this phenomenon, together with an increasing population under the poverty line, could impact income inequality. Researchers have discussed inequality in cities as a product of migration from rural areas and the process of adjustment and introduction to the high-skilled labor market (Kuznets, 1955; Young, 2013).

If an increasing amount of people are flocking to cities, a rise in inequality in these areas is to be expected.

Trends in income inequality show an increase in economic differences across different units of analysis. Between-nation and intra-nation income inequality have increased in the past decades, both in developed and developing countries (Firebaugh, 2000; McCall and Percheski, 2010; Alderson and Nielsen, 2002). Empirical studies have also shown that cities in the United States have become increasingly unequal in past decades, and differences in income between neighborhoods leads to economic segregation (Mayer, 2001; Wheeler et al., 2008; Hunter, 2003). This is particularly important, since higher levels of inequality leads to limited economic growth and large social costs, impacting education, occupational options, social cohesion, and other social indicators (Dabla-Norris et al. 2015). Especially in cities, inequality is negatively associated with city-level income and population (Bryan et al., 2019).

Income inequality has severe consequences, seen in every geographic unit of analysis. Neckerman and Torche (2007) have highlighted the social and political effects of inequality, like access to health services and the prevalence of certain diseases among specific income level groups, lower levels of education and hence lack of competitiveness in labor markets, higher crime rates, strained social relationships and political tensions. The political consequence of income inequality has been extensively studied. Rodríguez-Pose (2018) has attributed inequality between affluent urban areas and declining smaller towns and rural area as a reason for the rise of populism and the degradation of political and global institutions in Europe and the United States.

While researchers have extensively studied inequality across countries and within countries, inequality within cities has not been thoroughly studied. Economists successfully proved the positive correlations between inequality across cities and regions and other

specific variables, like city size, crime, education, and number of skilled-based industries (Braun, 1988; Daly et al., 2001; Glaeser et al., 2009; Lee et al., 2016). Also, wage inequalities, fast growing wages for high-skills workers, and agglomeration of high-income earners in big cities can explain the growing inequality in urban areas (Baum-Snow and Pavan, 2013; Sakar, 2018). Furthermore, there is insufficient research about these correlations across the world. Most of the work has been done focusing on a particular country, using country-specific characteristics that determine inequality, like racial composition (Deaton and Lubotsky, 2001; Bolton and Breau, 2012).

The world today is experiencing a significant demographic change characterized by urban growth. According to Engelke (2015), experts claim that by 2050 cities will contain two thirds of the world's population and cities are expected to grow by approximate 70 million people annually. This growth is associated with in-migration from people looking for job opportunities (Greenwood, 1975) and high-skilled people looking for economic and productivity benefits from urban agglomeration (Florida, 2012). Kuznets (1955) explained how income inequality arises from the rural-urban migration. Because of differences in skills and human capital, urbanization and development at the early stages causes more inequality, but as people adjust to the new labor environment, income disparities plateau and then decrease. Although Glaeser (2011) claims that urbanization improves the quality of life of people in the long run, it is important to highlight the potential problems that can arise from this rapid and prolonged growth. This migration process is expected to continue for the foreseeable future, possibly increasing in intensity as the world moves forward, and income disparities can be exacerbated if urbanization is left unchecked.

This research aims to study the impacts of urbanization in inequality. Specifically, population growth, population density growth, and urban growth will be analyzed to

determine if these variables have an impact in income inequality. A thorough literature review will be carried out to compile relevant work and determine the overarching variables that affect inequality across the world. Next, by using data on metropolitan areas from the OECD and based on the outcome of the literature review, a model will be designed, using the urban growth variables and control variables commonly used. Using OLS regression methods, this study shows that population and population density growth in cities is positively associated with income inequality, measured by Gini coefficient. A one percent increase in the population and population density growth increases Gini coefficient by 1.16%, and a one percent increase in urban area per capita growth decreases Gini coefficient by almost 0.1%. The effect of urban area growth doesn't seem to be important in terms of magnitude, but population density growth seems to be significant. The research also proves a negative relationship between the share of labor in manufacturing, unemployment, and disposable income with income inequality.

The results from this research can provide useful information and can lead to a discussion about urban and development policy issues around the world. One of the main motivations for this research is the benefit international development organizations can get from having information about inequality in cities on a global scale that can shape the dialogue on how to tackle these issues. In an increasingly urbanized world, most development projects will be focused on these areas, hence the importance of having an understanding on socioeconomic issues in cities, such as inequality. Furthermore, research approaches to urban inequality like this one can incentivize further research and measurements in developing countries and can help motivate development and government institutions to collect data on a city level.

The research is organized as follows. Section 2 will focus on previous work on income inequality within cities. Section 3 will compile relevant work on inequality, with a discussion

on different measurements and types of inequality. This section will also determine overarching variables across different sources of explanatory variables for this research. Section 4 will explain the data and methods of this study, with a clarification of the obstacles regarding data availability. This section will also lay out the specific model to be used based on the outcome of the conceptual framework. Section 5 will present the results. Lastly, a discussion on the outcome of the model is presented in section 6.

2. Background

Income inequality has been studied by several researchers, all of them offering different theories and models. There are also several theories to explain income inequality in urban settings. Some overarching theories name trade and globalization, and technology and skilled labor among some of the drivers of inequality. Place-based analyses also point out location of industries, as well as the geographical advantages, as explanations of inequalities across regions or cities. Lastly, theories on income inequality among individuals also indicate specific drivers like institutional factors that impact people based on sex, age, education, race, occupation, and many other key characteristics. In this section, a discussion on different theories on income inequality will be presented, both on a general level and with a place-based perspective.

2.1. Different perspectives on inequality

Discussions about inequality mostly focuses on differences in earnings. It is important to also highlight other perspectives on inequalities people suffer that are tangential to income, such as access to services or opportunities. Furthermore, when referring to income inequality,

it is important to discuss the different measures and how they describe the income disparities. In this section, this study will discuss different approaches to inequality, from income to access of services, and will also describe the different measurements of inequality.

Although income inequality is the most common measurement of inequality, there are several other aspects of society where disparities among groups are present. Inequality can also be present across groups according to specific characteristics, and can reflect disparities in income, education, and access to society's resources. Elliott and Haney (2007) discussed racial discrimination of African Americans in the United States and its impact on inequality, in terms of income but also educational outcomes. They highlighted the fact that school districts shape academic and labor outcomes within African Americans suffering as a result of these districts being segregated. Bolton and Breau (2012) studied the impact of the presence of racial minorities in the level of inequality within cities, further corroborating a racial component of inequality. The issue of racial segregation, present in inequality in educational attainment and access to education in the United States, has a noticeable effect in urban inequality (Goldsmith, 2010) such things as inequality in access to fresh food, a phenomenon called food deserts (Wrigley et al., 2003). Adams (2007) claims that specific biological characteristics of women have been used to discriminate against them, generating inequalities based on gender that pertain to education, health, access to labor markets, and treatment in the legal system. Although most of these variables can impact directly on income, they are measurements of inequality in itself and have caught the attention of researchers studying disparities between certain groups. This discussion, although not central to this research, is pertinent because of the geographical components of these disparities, particularly with regards to racial and poverty segregation within cities.

2.2. Inter-national and intra-national theories of inequality

Economists have long studied the uneven distribution of income across different units of observation, whether it is households, people, cities, or countries. Human capital is one of the main drivers of inequality. Becker and Tomes (1979), for example, explain that the main drivers of income inequality, both intergenerational and cross-sectional, are investment in human capital (or endowments) and luck. Dabla-Norris et al., (2015) explain that educational attainment influences choices in occupation and access to jobs, which ultimately determine levels of pay. The authors also explain that, while there are different forces driving the relationship between human capital and education, overall education improves the lives of people, increases their income, and generates prosperity.

In trying to explain income inequality across countries, Acemoglu (2003) points out that the differences in inequality between the United States and Europe is related to wage-setting institutions and its impact on supply and demand of skilled labor. European countries, according to Acemoglu, have different institutions that intervene in wage setting, like union bargaining, unemployment benefits and minimum wages, that reduces the differences in earnings between low-skilled and high-skilled workers. Because of these institutions, Acemoglu argues that European firms have more incentives to adopt technologies to increase productivity. If a firm is forced to pay higher wages to its low-skilled workers, the firm would invest in technologies to compensate for that loss of productivity and low-skilled workers do not benefit from higher productivity with higher wages. This mechanism has created an equilibrium in European countries not found in the United States; there are no such wage-setting institutions and American firms can hire low-skilled workers with lower wages. Katz and Summers (1989) have argued that American firms tend to provide “low wage, bad jobs” and benefit from labor rents. This explains why inequality in the United States is higher than

in Europe. Trade also impacts the labor skill dynamic and inequality. Meschi and Vivarelli (2009) have shown that middle income countries that are more open to trade with developed countries are more unequal. The authors explain that the skill-biased technologies and technological differentials might be the causes of this disruption.

There are several theories on regional inequality that are worth noting. Kim (2008) summarizes these theories in two groups. On one hand, there are neoclassical models arguing that, assuming constant returns to scale and perfect competition, governments are only limited to infrastructure projects that affect mobility of goods and production factors. Two important neoclassical models are the Ricardian model, which analyzes the comparative advantages in technology, and the Heckscher-Ohlin model, stating that the differences come from resource endowments. On the other hand, there is the New Economic Geography model based on increasing returns to scale, trade costs, endogenous firm location and endogenous location of demand. In this model, lowering transportation costs of goods can generate agglomeration effects. Some firms locate in places based on demand and manufacturing costs and once these areas gain advantage, they continue to grow because of increasing returns to scale. This attracts more firms to the area, creating a center-periphery pattern where cities develop faster than their rural surroundings. In a model with migration, if the wage ratio between regions increase with the share of manufacturing labor force in a region, then people will move to those developed areas and regions will diverge (Krugman, 1991).

3. Literature Review

A vast array of studies has been carried out to explain income disparities around the world. Different empirical inquiries have focused on inequality between countries and within

countries. To focus the discussion, this section will briefly examine previous literature on causes of inequality around the world, laying out a discussion on disparities across countries and within countries. Subsequently, a review of previous research on city inequality will be discussed. Finally, this section will present a review of previous literature about the relationship between city size, urbanization, poverty, inequality.

3.1. Cross-national and national inequality

Researchers have studied the causal relationship between income inequality and a variety of different phenomena, like globalization, education, resource endowment, technology, government interventions, and trade. While different studies focus on the impact of a specific variable on inequality, most of the literature agree that a collection of endogenous and exogenous variables explain income inequality. Dabla-Norris et al. (2015) name skill-biased technological change, trade openness, changes in institutions within the labor market, redistributive policies and education all play an important role in cross-country inequality. Leamer et al. (1999) have argued that countries in Latin America with strong industry sectors based on natural resources tend to accumulate capital in those particular sectors and away from others, such as manufacturing, disincentivizing workers skill acquisition. The existence of redistribution policies such as progressive taxation and public transfers have also been associated with lower levels of inequality (Zaidi, 2009; Dabla-Norris et al., 2015).

Income inequality has also been studied within specific countries. Theoretical discussions and empirical research on regional inequality have shed light on the causes of the spatial distribution of income. The rural urban pattern is one of the patterns that have been widely discussed. The idea that cities develop faster and attract more prosperity than rural areas is largely proven. Eastwood and Lipton (2000) concluded that there is no global trend in the

difference between rural and urban areas, meaning that while in Africa the divide has narrowed, in Asia it has widened. However, these authors did find a rising urban bias in education, one of the main drivers of inequality. Johnson and Whitelaw (1974) discussed the phenomenon of substantial wage differentials in the least developed countries by researching on the disparities in Kenya and the burden urban dwellers face in supporting families in rural areas. Li and Zhao (2007) determined that the divide, in terms of income, between urban and rural areas in China has grown amid the economic expansion of that country.

In the United States, there have been several research studies on the spatial distribution of income inequality. Silva and Leichenko (2004) found that trade, specifically the price of imports and exports, affects income inequality distribution across states. In Spain, labor productivity differentials and industrial specialization, in the midst of economic growth, promoted the concentration of certain industries in specific regions, creating inequalities (Rosés et al., 2010). Geographic patterns have also been analyzed and researchers have studied how income distributes through geographical features. Rappaport and Sachs (2002), for example, claim that attributes of coastal areas in the United States contribute to higher productivity and also higher quality of life.

3.2. Inequality in cities

There have been several studies about the differences in income between urban and rural populations. In China, fiscal policies like subsidies or tax benefits, regional development strategies such as special economic zones, and government intervention in factor markets like the restriction on internal migration, have generated regional inequalities and an urban-rural divide, where cities attract development and prosperity and rural areas are left behind (Yang, 2002). Shahbaz et al. (2007) found that while improvement in financial performance

decreases urban-rural inequality, economic growth and trade openness have a negative effect on the even distribution of income across region. Although these countries have striking differences, many of the variables tested are common among the literature on income inequality.

While studying inequality across cities, researchers have used similar variables to those used in regional or worldwide inequality. However, most of the research is focused on cities from a particular country. Florida and Mellander (2016), for example, explain that while wage inequality within metropolitan areas in the United States is closely associated with skills, human capital, technology, and city size, income inequality is more closely related to unionization, race, and poverty. Glaeser et al. (2009) found that one third of the variance of income inequality within cities is explained by the difference in skill distribution and one third of the variation is explained by the difference in occupation. City size has also been researched as a main driver of inequality among cities. Bolton and Breau (2012) proved the contribution of city size, together with unemployment, deindustrialization, and share of minority groups, to income inequality in Canadian cities. Lee et al. (2015) proved that the most unequal cities in the United Kingdom are the most affluent ones, claiming that city size is associated with higher wages at the top of the wage distribution.

Differencing from inter-city analysis, research within cities show different other variables that explain spatial distributions of income inequality. Lelo et al. (2019) found that proximity to the densely populated city center, accessibility to municipal functions and services like cultural centers, job density, and unemployment are related to income inequality in Rome. Wheeler et al. (2006) proved that inequality within neighborhoods in American cities is driven, among other things, by the percentage of minorities within those areas, showing the persistent impact of racial segregation.

3.3. Urbanization, poverty and inequality

While many researchers and economists have argued that with urbanization comes development, all of them also acknowledge problems like income inequality and poverty concentration. Although Glaeser (2011) asked why do the rich and the poor all live in close proximity, referring to the success of urbanization in improving people's lives, many experts admit the concentration poverty in large cities and its consequences.

The United Nations has claimed that urbanization has been a positive force for countries' economic development, helping with poverty reduction and human development by concentrating innovation and entrepreneurship, by scaling services like water and sanitation, and by concentrating knowledge and skills (UN-DESA, 2018). However, with this development comes concentration of poverty, racial segregation, and inequality. Goldsmith and Blakely (2010) discussed the increasing trend in income inequality in cities and suburbs in the United States, arguing that large metropolitan areas also concentrate families, largely minorities, struggling with low wages, rising prices, failing public services and discrimination. According to the authors, cities trying to be globally competitive by reducing spending end up not investing in critical services that benefit the majority of the residents. They argue that well-off suburban areas can afford to invest in education, health and other services, while inner cities grapple to provide affordable services to those in need. Ravallion (2002) proved that the poor urbanizes faster than the nonpoor, and the author predicts that by 2020, the urban share of poverty will be 40% while the urban share of the population will be 52%. Thus, even though urbanization brings significant changes in society in terms of wealth and prosperity, it also creates severe problems, with poverty and inequality being in close proximity with urban development.

While researchers have studied urbanization, poverty, and income inequality among countries with different results, the related literature is scarce at the city level. Wheeler (2004) found a negative relationship between wage dispersion and city population density in the United States. Liddle (2017) found either no relationship or a U-shaped relationship between poverty and urban-rural gaps, but in countries with higher urbanization levels, increases of urbanization intensifies urban poverty and rural-urban gaps. Chen et al. (2016) proved a negative relationship between urbanization and income inequality in provinces in China. Baum-Snow and Pavan (2013) proved that 23% of the overall increase in wage differential is explained by city size, measured by deciles of the urban population distribution. These researches demonstrate how urbanization dynamics like population density and growth can impact income inequality.

Previous studies show inconsistent results when analyzing the relationship between urban density and income inequality. Wheeler (2004) found that wage inequality, the difference in wages between high skilled and low skilled workers, is negatively associated with population density. In the United States, as cities become decentralized and spread out, between-neighborhood income do not rise, and this may be associated with income and industrial heterogeneity within neighborhoods in a context of migration from city core to suburbs (Wheeler, 2006). However, as neighborhoods spread and become heterogeneous, the interactions between them might decrease, making it harder for less-skilled workers to learn from their counterparts and increasing inequality (Wheeler, 2006; Glaeser, 1999). Florida (2017), however, claimed that economic development and increasing concentration of highly skilled people in urban areas has increased income inequality in cities.

4. Conceptual Framework

This research focuses on urban growth and income inequality. In this section, the conceptual model for this research will be explained. The first part lays out the theory behind the conceptual model. The second part explains in detail the model, with the hypothesis behind it.

4.1. Theories on city growth and inequality

The process of urbanization and its impact on inequality has been studied by researchers, focusing on different units of analysis and with different results. However, key points in their theoretical explanations are overarching. Kuznets (1955) argued that urbanization and industrialization, which are products of economic growth, bring income inequality at early stages, but these differences in income plateau and then decrease with consistent economic growth. The author claims that wealth inequality increases because of the differences between newcomers and existing residents of cities, specifically because migrants face a period of adjustment to the urban life, including changes in the labor market. After this adjustment period, and with economic development still present, inequality plateaus and then decreases, showing an inclusion of migrants to the economic and labor dynamic of the city. This phenomenon was labeled the Kuznets curve and has been well debated by economists since its inception. Other theories focus on the impact of wage differential, especially in the presence of higher minimum wages in cities, on migration and the ability of those who come from rural areas towards the city to obtain jobs in the formal sector, where high-paying jobs are (Harris and Todaro, 1970; Rauch 1991). Wu (2019) proved that the relationship between city size and income inequality is concave, conclusive with the Kuznets

idea of urbanization and inequality. According to this research, rising inequality, in relation to city size, is not permanent, as it peaks and then falls as population continues to grow.

Many researchers have studied the impact of city growth in income differentials through housing market and demand from high skilled labor and firms. Potepan (1992) explains that inter-metropolitan migration, the primary source of variation in population growth, and housing prices are directly related to each other. However, the author claims that there is a discussion on which of the two opposing forces prevail, out-migration because of higher housing prices and in-migration because of amenities. Rosen (1979) and Roback (1982) both develop models of amenities and income inequality in cities. According to the Rosen-Roback model, highly skilled people with higher wages are attracted to cities with more amenities, like weather, clean air, and population density, and this explain income differential across cities. For these authors, the phenomenon of migration, city growth, and income inequality goes as follows: high-skilled workers with higher earnings demand to live in areas with higher amenities, pushing those who can afford to live in those areas out. Furthermore, the pressure from firms locating in cities because of technological economies of scale creating higher paying jobs and higher expected earnings in these areas than those without this economic advantage also influences migration (Henderson, 1974; Harris and Todaro, 1970). Since cities grow mainly from migration, those that grow faster are because they attract people with higher paying jobs (or just more available jobs) and amenities, and higher paid workers will locate close to amenities while those with low-paying jobs will locate in other less developed areas of the city. Overall, the metropolitan area grows, but racial segregation and income inequality also grow.

The phenomenon of rural-urban migration and city growth, and its connection with poverty and inequality is important in understanding the conceptual model of this analysis.

There are extensive theoretical discussions about how this process unfolds. Saunders (2011) developed the concept of arrival city, these urban areas either adjacent or in large metropolises that receive migrants from rural areas or small towns trying to improve their economic situation. According to the author, these neighborhoods or suburbs have different characteristics depending on the country, from the marginal slums of Latin America and Asia to the “ethnoburbs” of the United States. However, Saunders explains that they concentrate low income migrant families, they have deep connections with the metropolis, and most of these areas receive little investment from governments and private sector. The author concludes that, over a certain period of time, these arrival cities become part of the core metropolis, as the city develops and grows, and new arrival cities are created in other parts of the region. This is particularly important for the purpose of this analysis, because it paints the picture of the dynamic of city growth. People looking for better economic opportunities settle in specific neighborhoods in cities. Rapid city growth means an increase in incoming people relocating to these arrival cities, and this impacts the income distribution of the metropolitan area.

As urban areas develop, arrival cities tend to gentrify, bringing more affluent settlers. This phenomenon has occurred in many cities across the United States and Europe, where neighborhoods close to downtown areas, previously populated by low-income families, minorities, and migrants (both international and domestic from rural areas), are now high cost of living areas populated by middle- and high-income households. From New York City to Washington, DC to London, neighborhoods and areas have faced a significant change in income distribution (Saunders, 2011; Freeman and Braconi, 2004; Butler et al., 2013). A change in income distribution may also bring a change in population density. Black et al. (2002) proved that gay male couples can afford to live in expensive areas of San Francisco

because they generally do not have children. The underlying discussion in this paper is the idea that families, especially low-income ones, are forced to move out of the city to suburbs and exurbs because of rising costs and lack of affordable space in cities. This demonstrates a relationship between income distribution and density in metropolitan areas.

Economic theories have also focused on the economic benefits of residents and firms to locate in cities. A main argument to explain income inequality is the fact that firms locate in large urban areas, making high-paying jobs available in few specific places. A classic model by Henderson (1974) offers an explanation on the differences in cities. Land rents and commuting costs tend to make cities sparser while Marshallian or agglomeration externalities tend to make them bigger. The balance of these forces determines the size of cities. Kim (2008) argues that urban inequality, following Henderson's model, arises when these agglomeration benefits are strong in a few industries. These theories are related to the relationship between city size and inequality and are also consistent with previously discussed explanations, relating to economic opportunities.

There are other drivers of urban inequality besides city size that are worth discussing. Concentration of human capital can also explain urban inequality. Rauch (1993) argues that cities with high levels of human capital should have higher wages. Glaeser et al. (2009) empirically prove that human capital, in the form of educational attainment, drives inequality in cities. Thus, inequality arises when differences in skills and education exist. The concentration of skill-biased technological change is also a significant driver of inequality, because it increases demand for high-skilled labor, increasing the wage difference between high and low skilled workers (Autor et al., 1998). Baum-Snow and Pavan (2013) conclude that cities with a concentration of high skilled people and industry have higher levels of

inequality. However, in high-amenity and expensive locations, like large and affluent metropolitan areas, returns to education are low (Black et al., 2009).

The concentration of human capital in large urban areas, and its relationship with income inequality, leads to a different, but not opposite, narrative from the one about arrival cities. In recent years, downtown areas have increasingly been receiving more affluent people, changing the premise that households with high wages move to suburbs. Previous studies discussed the idea of a negative relationship between population density and income inequality (Wheeler, 2006). Florida (2012), in his revision of his theory of the Creative Class, stated that people belonging to this group, highly skilled people, tend to cluster in high density urban areas, and benefit economically from it. The author stated that the key to economic success of cities depended on the attraction of talented people, and cities certainly delivered. As more talented people from this Creative Class clustered in urbanized areas, cities began to flourish again, but not without increasing income inequality. Florida (2017) stated that metropolitan areas with the most dynamic and successful economies are also those with high levels of wage inequality, and that the rise of the Creative Class, its clustering in certain cities, and its economic success, brought racial segregation, poverty concentration, and displacement in urban areas. According to the author, the reviving of urban centers came at the expense of declining cities and suburbs, where crime, poverty, and economic and racial segregation increased.

From the theories laid out in this section, the following storyline can be synthesized. Population growth increases income inequality in cities. More specifically, the concentration of highly skilled people, human capital, and jobs in cities is associated with income disparities. Economic benefits and amenities attract high-skilled people with higher wages, and the concentration of better paid jobs attract less affluent people looking for economic

prosperity. These different groups struggle for a space in the city and those who can afford it succeed. Those who cannot afford it, locate adjacent to the urban core, fighting for an opportunity to improve their economic status and join those more affluent people in their neighborhoods which have higher qualities of life.

4.2. Conceptual model and research hypotheses

Following the different theories on inequality exposed above, this research will analyze the relationship between urban growth and inequality in cities. The model follows the narrative explained in the previous section: income inequality is tied to population growth, but also determined by the concentration of skilled jobs, human capital and income. This conceptual model is portrayed in the following graph:

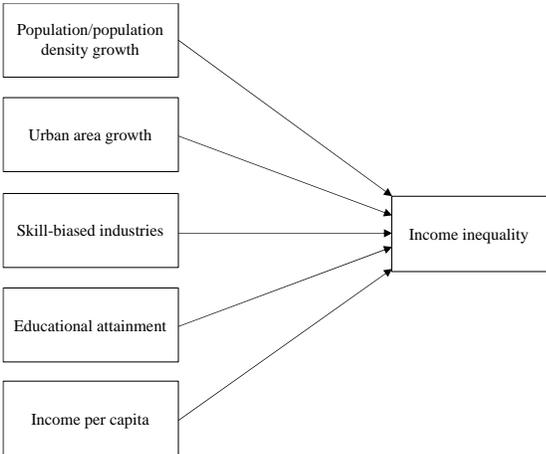


Figure 1: Conceptual framework

For this analysis, three main aspects of urban growth will be analyzed: population growth, population density growth, and urban area growth. This model also includes variables used in the extensive literature analyzing income inequality: education, income per capita, and

skill-based industries. Controls will also be added to the model, like income per capita and country inequality.

Following the findings of previous research and the aforementioned narrative, this model should prove that urban growth is positively related to income inequality. As urban population and population density grows, cities should experience higher levels of income inequality. The concentration of high-skilled jobs should also be positively related to income inequality. Lastly, the concentration of highly skilled people should also increase income disparities in cities.

5. Data and Methods

This section will lay out the data sources of this research project and the obstacles the datasets pose to the objectives of the project. Furthermore, the empirical model will be discussed, with robustness checks.

5.1. Data

The objective of this research is to study the relationship between city growth and income inequality within cities across the developed world. For this, data is retrieved from the OECD Regional Statistics dataset on metropolitan areas. Cities in Europe and North America were taken as sample for this study. Table 1 shows the countries and the cities to be included in this analysis, with their city size categories. Large metropolitan areas are those with more than 1.5 million people. The OECD metropolitan database collects information based on functional urban areas (FUAs), which encompass the city and its commuting zone. According to the metadata, FUAs represent the economic and functional area of cities based on its

population movement, its area of influence beyond administrative boundaries (OECD, 2012).

This database provided information on income inequality, urban area characteristics, population and income¹. The data of this research is also complemented with information on labor and education provided by national statistic agencies.

Table 1: Cities, countries and city size of the sample

Country	City	City size	Country	City	City size	Country	City	City size
Austria	Linz	Metro	United Kingdom	Coventry	Metro	United States	Denver	Large Metro
Austria	Graz	Metro	United Kingdom	Manchester	Large Metro	United States	Cincinnati	Large Metro
Austria	Vienna	Large Metro	United Kingdom	Sheffield	Metro	United States	Ventura	Metro
Canada	Sherbrooke	Metro	United Kingdom	Preston	Metro	United States	Summit	Metro
Canada	Hamilton	Metro	United Kingdom	Middlesbrough	Metro	United States	San Joaquin	Metro
Canada	Halifax	Metro	United Kingdom	Milton Keynes	Metro	United States	Greene	Metro
Canada	Montreal	Large Metro	United Kingdom	Leicester	Metro	United States	Jefferson (AL)	Metro
Canada	London	Metro	United Kingdom	Bristol	Metro	United States	Jackson (MO)	Large Metro
Canada	Winnipeg	Metro	United Kingdom	Norwich	Metro	United States	Hamilton (TN)	Metro
Canada	Windsor	Metro	United Kingdom	Northampton	Metro	United States	Volusia-Daytona Beach	Metro
Canada	Saskatoon	Metro	United Kingdom	Derby	Metro	United States	Stanislaus	Metro
Canada	Vancouver	Large Metro	United Kingdom	Exeter	Metro	United States	Charlotte	Large Metro
Canada	Toronto	Large Metro	United Kingdom	Bournemouth	Metro	United States	Spokane	Metro
Canada	Calgary	Large Metro	United Kingdom	Nottingham	Metro	United States	East Baton Rouge	Metro
France	Nantes	Metro	United Kingdom	Portsmouth	Metro	United States	Boston	Large Metro
France	Rennes	Metro	United Kingdom	Leeds	Large Metro	United States	Detroit (Greater)	Large Metro
France	Saint-Etienne	Metro	United Kingdom	Southampton	Metro	United States	Lucas	Metro
France	Bordeaux	Metro	United Kingdom	Cardiff	Metro	United States	Davidson	Metro
France	Toulon	Metro	United Kingdom	London	Large Metro	United States	Pittsburgh	Metro
France	Grenoble	Metro	United Kingdom	Reading	Metro	United States	Orange	Large Metro
France	Rouen	Metro	United Kingdom	Oxford	Metro	United States	Providence	Metro
France	Toulouse	Metro	United Kingdom	Cambridge	Metro	United States	Jacksonville	Large Metro
France	Strasbourg	Metro	United States	Lancaster (PA)	Metro	United States	Sacramento	Large Metro
France	Lille	Metro	United States	Albany	Metro	United States	Milwaukee	Large Metro
France	Montpellier	Metro	United States	Dauphin	Metro	United States	Oklahoma	Metro
France	Lyon	Large Metro	United States	Richland	Metro	United States	Cuyahoga	Large Metro
France	Nice	Metro	United States	El Paso (CO)	Metro	United States	Kern	Metro
France	Marseille	Large Metro	United States	Minneapolis	Large Metro	United States	Seattle	Large Metro
France	Paris	Large Metro	United States	Virginia Beach	Metro	United States	Memphis	Metro
Italy	Catania	Metro	United States	Lehigh	Metro	United States	Las Vegas	Large Metro
Italy	Venice	Metro	United States	Worcester	Metro	United States	San Diego	Large Metro
Italy	Palermo	Metro	United States	Erie (NY)	Metro	United States	San Antonio	Large Metro
Italy	Florence	Metro	United States	Onondaga	Metro	United States	Tulsa	Metro
Italy	Genoa	Metro	United States	Utah	Metro	United States	Guilford	Metro
Italy	Padua	Metro	United States	Dane	Metro	United States	Indianapolis	Large Metro
Italy	Verona	Metro	United States	Rochester (NY)	Metro	United States	Philadelphia (Greater)	Large Metro
Italy	Milan	Large Metro	United States	Douglas (NE)	Metro	United States	Atlanta	Large Metro
Italy	Bologna	Metro	United States	Polk	Metro	United States	El Paso (TX)	Metro
Italy	Rome	Large Metro	United States	Wake	Metro	United States	Sarasota	Metro
Italy	Naples	Large Metro	United States	Sedgwick	Metro	United States	Washoe	Metro
Italy	Turin	Large Metro	United States	Charleston	Metro	United States	Austin	Large Metro
Italy	Bari	Metro	United States	Jefferson (KY)	Metro	United States	Lee	Metro
Norway	Oslo	Metro	United States	Hartford	Metro	United States	St. Louis	Large Metro
Portugal	Porto	Metro	United States	Salt Lake	Large Metro	United States	Phoenix	Large Metro
Portugal	Lisbon	Large Metro	United States	Washington (Greater)	Large Metro	United States	Fresno (Greater)	Metro
Sweden	Gothenburg	Metro	United States	Portland	Large Metro	United States	Pima	Metro
Sweden	Stockholm	Large Metro	United States	Hampden	Metro	United States	Chicago	Large Metro
Sweden	Malmo	Metro	United States	Kent	Metro	United States	Dallas	Large Metro
United Kingdom	Swansea	Metro	United States	Richmond (Greater)	Metro	United States	New Orleans	Metro
United Kingdom	Sunderland	Metro	United States	Columbus	Large Metro	United States	Los Angeles (Greater)	Large Metro
United Kingdom	Ipswich	Metro	United States	Pulaski	Metro	United States	New York (Greater)	Large Metro
United Kingdom	Plymouth	Metro	United States	Fayette	Metro	United States	Albuquerque	Metro
United Kingdom	Doncaster	Metro	United States	Montgomery (OH)	Metro	United States	Houston	Large Metro
United Kingdom	Liverpool	Metro	United States	Brevard	Metro	United States	Hidalgo	Metro
United Kingdom	Blackpool	Metro	United States	Ada	Metro	United States	New Haven	Large Metro
						United States	Miami (Greater)	Large Metro

Source: OECD

¹ Gini coefficient of cities in the United Kingdom were retrieved from Centre for Cities

There are several methods to measure income inequality, like variance of wages and percentile ratios (Jappelli and Pistaferri, 2010). The Gini coefficient is one of the most popular ones and is based on another measurement, the Lorenz curve. Schutz (1951) explain the differences between both measurements. The author first defines inequality measurement as any deviation from complete equality. The Lorenz curve and the Gini coefficient, according to the author, is based on the number of income recipients and the aggregate income. While the Lorenz method simply portrays the differences between the distribution of income curve from complete equality line, the Gini coefficient is a relative term that compares the differences in the distribution of income curve, the equality line, and the area encompassing both curves. Although several authors have debated whether one measurement is better than the other, data on the Gini coefficient is more widely available.

To measure inequality, this research uses Gini coefficient of FUAs. To measure city growth, we use different variables related not only to population but also urban area growth. For population growth and population density growth, this research uses the percentage increase of population from 2000 to 2016. Urban growth is defined as the built-up area for urban use in square kilometers. For skill-based industries, this analysis uses Braun (1988) approach, by including the share of the labor force in the city in manufacturing jobs. This way, we study the impact of the share of low-skilled jobs in the city and its impact on inequality². The model includes the share of population with postgraduate degrees, disposable income per equivalized household, unemployment rate, retrieved from the OECD Metropolitan Database, and Gini coefficient of each country, taken from the World Bank

² The idea that manufacturing jobs are low skilled is in relative to other industries, such as finance.

Open Data. Educational attainment and share of manufacturing jobs were both retrieved from national statistic agencies.

5.2. Empirical Model

The model developed in this research follows the conceptual model explained before. It uses the Gini coefficient as the dependent variable. Different measures of urban growth are used. The relationship between population growth and population density growth with income inequality is tested separately. Urban area growth is included in both analyses. The equations also include educational attainment, share of manufacturing jobs and income per capita, and controls for population, unemployment and income inequality of the country. To measure education, the model uses the proportion of the population in each city with post graduate diplomas. The share of the manufacturing industry in the city's economy is used as a proxy for the impact of skill-biased industry. Unemployment rate is in logarithmic form to correct for outliers. Income is measured by the disposable income by equivalized household in USD (PPP base 2010).

This research uses a simple OLS regression method and a panel data regression model. Equations (1) and (2) show the basic form of the empirical model:

$$(1) \text{GINI}_i = \alpha + \beta_1 \text{PopulationGrowth}_i + \beta_2 \text{UrbanAreaGrowth}_i + \beta_3 \text{ShareManufacturing}_i \\ + \beta_4 \text{Education}_i + \beta_2 \text{IncomePerCapita}_i + \beta_5 \text{CONTROLS}_i + \varepsilon_i$$

$$(2) \text{GINI}_i = \alpha + \beta_1 \text{PopulationDensityGrowth}_i + \beta_2 \text{UrbanAreaGrowth}_i + \beta_3 \text{ShareManufacturing}_i \\ + \beta_4 \text{Education}_i + \beta_2 \text{IncomePerCapita}_i + \beta_5 \text{CONTROLS}_i + \varepsilon_i$$

It is expected that inequality increases with higher levels of population growth and population density growth. It is also expected that the variable measuring skill-biased industries in the area to have a positive relationship with inequality. However, the proxy variable used, the share of manufacturing industries, would work in the opposite way, since these types of firms are not skill biased (Braun, 1988). Given the fact that there are many skill-biased industries and because many cities and countries do not have the same level of data granularity, this study justifies the use of this variable. There should also be a significant difference between developed and developing countries.

6. Results

6.1. Descriptive statistics

The results in Table 2 show the mean, standard deviation, and minimum and maximum observation of the variables of interest. All of the cities in the sample have levels of income inequality lower than 50%, the average being 36.12%. The small range and small standard deviation of the Gini coefficient in cities is explained by the countries from which the sample of cities were taken. French cities are the most equal of the sample, while American and British cities are the most unequal. All the countries in the sample have similarly low levels of inequality. The range of Gini coefficient values in OECD countries goes from 24% to 46%, with lower levels of inequality in Western Europe and Canada and higher levels in the United States and the United Kingdom (OECD, 2020). The standard deviation of the urban growth variables, growth in urban area, population and population density growth are high. The wide range of observations in urbanization variable proves how different these cities are from each other, making the analysis and the comparison between cities easier, especially in

the face of lower variance in the output variable. This is true also for population, having both very large metropolises, like New York City and Los Angeles, and smaller cities of over 250,000 people. The average share of people in manufacturing jobs is lower than the OECD average of 11.5% (OECD, 2019), but there are industrial cities (close to 30% share of manufacturing jobs) in the sample as well as big financial centers (with close to 2%). These metropolitan areas also have a big share of people with postgraduate degrees.

Table 2: Summary statistics

Variable	Observations	Mean	Standard Deviation	Min	Max
Gini Coefficient	166	36.12	4.72	24.15	46.00
Growth in population density	166	0.95	0.71	-0.26	3.14
Growth in urban area	166	14.00	7.75	0.00	38.62
Disposable Income	152	35,573.47	7,994.67	14,295.15	55,768.22
Population	166	1,845,912.00	2,750,258.00	250,370.00	20,200,000.00
Population growth	166	0.95	0.71	-0.26	3.14
Share of labor force in manufacturing	162	9.28	5.15	2.10	27.34
Share of population with postgraduate degrees	166	31.98	8.78	14.20	65.00
Country Gini coefficient	166	37.70	4.23	27.50	41.50
Unemployment rate	160	6.25	3.24	2.96	25.10

Sources: OECD, Centre for Cities, national statistic agencies.

Figure 2 represents the relationship between the Gini coefficient and the variables of interest, with city size labeled. The black line is the linear prediction line. Cities with higher population density growth are more unequal, but cities with faster growing urban areas have lower levels of inequality. The both relationships are consistent with the idea that faster urbanizing cities tend to have higher levels of inequality. Higher population density growth means the population of the city is growing faster, meaning it attracts people from other parts of the country as well as the growth from births. A growth in urban area per capita means that in the city there is more urban area per person than before, the contrary of density. The lower the share of manufacturing jobs the more unequal cities are, and the higher the

unemployment rate the lower Gini coefficient in cities is. Both of these relationships are consistent with the literature on income inequality (Braun, 1988). Figure 2 shows outliers in the unemployment rate variable, which are later corrected. The relationship doesn't seem to be strong with educational attainment and urban area growth.

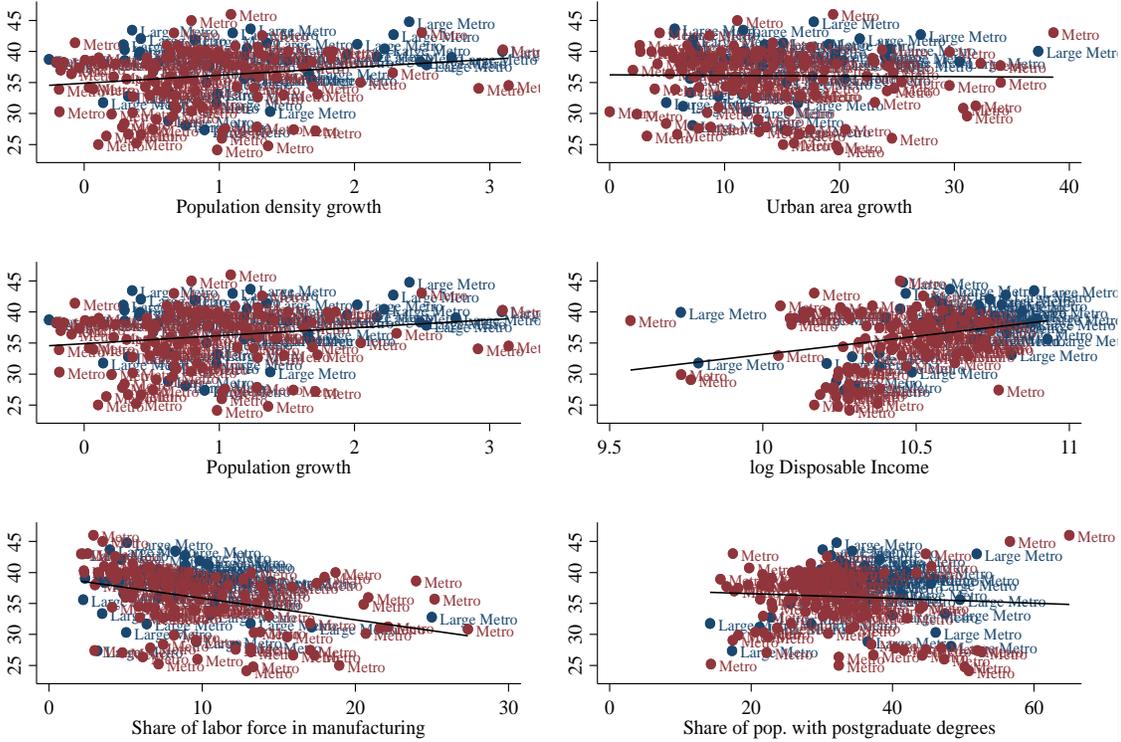


Figure 2: Two-way comparisons between Gini coefficient and variables of interest by city size

From the sample, the most unequal cities are those in the United Kingdom, Canada and the United States. From the top 20 most unequal cities in the sample, half are large metropolitan areas and the other half are cities with less than 1.5 million people. The most equal cities are in Europe: France, Austria and Nordic countries. From the top 20 most equal cities, only three are large metropolitan areas. In terms of population growth, there is no geographical pattern. Cities in the United State Rust Belt continue to decrease in population and population density, while cities in southern states grow faster (Austin, Las Vegas,

Orlando). Large metropolitan areas tend to grow faster than smaller cities, but the largest cities in population (New York, Paris, London, Los Angeles) are not the fastest growing. This is also seen with population density. The most densely populated urban areas are not those that grow the fastest. For population growth, this phenomenon could very well be because of the initial level of population. Cities of 10 million people have slower rates but not necessarily have smaller migration flows. However, very large cities have different population densities. From the sample, the most populated cities are not necessarily the most densely populated ones.

Large metropolitan areas, in terms of population, are more unequal than smaller cities. This is especially the case with population density, where larger metropolitan areas are denser and more unequal. Figure 3 shows the Gini coefficient in cities according to city size. Smaller metropolitan areas seem to be more equal, but there is a big variability in this sample. The two outliers in the Gini coefficient box plot are two cities in Europe, Vienna and Lyon, proving that, in general, European cities are more equal.

In large metropolitan areas, population and population density grew higher than in smaller cities. However, the range of growth in larger cities is higher, showing that not all of them grew more than smaller towns. Figure 3 displays the box plots of population and population density growth. The three outliers in these two graphs are Wake County (Raleigh, North Carolina), Lee County (Cape Coral, Florida) and Utah County (Provo, Utah). The figure also shows a slight difference in urban area growth and share of people with post-graduate degrees between smaller and larger metropolitan areas. Larger metropolitan areas have higher disposable income per capita and lower share of manufacturing jobs.

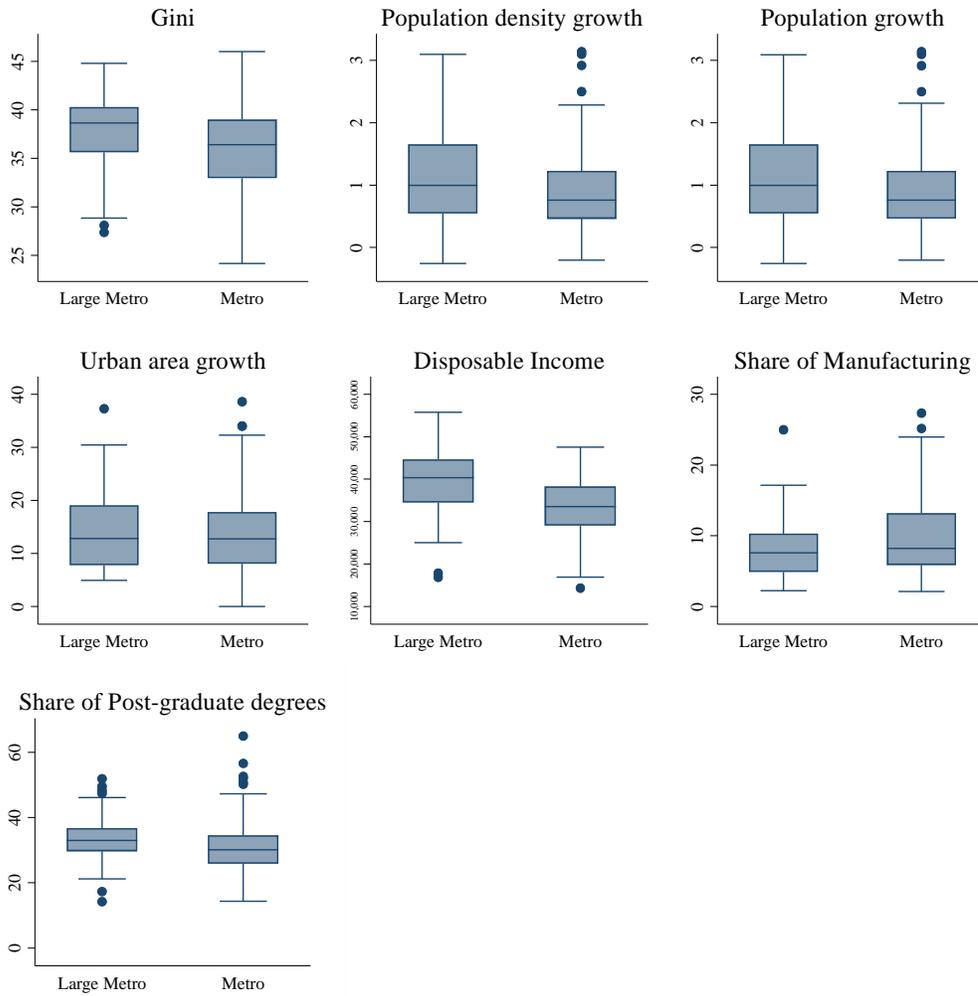


Figure 3: Box plot of variables of interest

6.2. Regression results

Table 2 shows the results of the OLS regression. Regression A shows the relationship between Gini coefficient and population density growth, while regression B shows population growth. The table displays the coefficients, resulting from each regression, with their standard errors. The stars show statistical significance at 10%, 5% and 1%. Every variable in regressions A and B are statistically significant at least at the 10% level, except for population and educational attainment. A one percent increase in the population and

population density growth increases Gini coefficient by 1.16%, and a one percent increase in urban area per capita growth decreases Gini coefficient by almost 0.1%. The effect of urban area growth doesn't seem to be important in terms of magnitude, but population density growth seems to be significant. The relationship between the share of labor in manufacturing, unemployment, and disposable income with income inequality is negative, consistent with the literature (Braun, 1988). Research behind unemployment is varied with different conflicting results that is not the focus of this study.

Two variables are not statistically significant: educational attainment and population. The sample data is taken from countries with already high levels of education, and the analysis is focused on relatively large cities and metropolitan areas, all of which concentrate high levels of highly skilled labor. This may be the reason why in this analysis educational attainment doesn't explain income inequality. If cities from the developed world are included in the sample, with different levels of educational attainment, these results might change. The reason why population is not statistically significant may be due to sample of cities. More than two thirds of the cities chosen are mid-sized metropolitan areas. With a sample of smaller towns and big metropolitan areas, a statistical significance may arise.

Table 3: Regression results

Dependent variable: Gini coefficient	Coefficients	
	A	B
Growth in population density	1.160543 (0.605)**	-
Growth in population	-	1.159312 (0.604)**
Growth in urban area	-0.0887726 (0.042)**	-0.08868 (0.042)**
Share of labor force in manufacturing	-0.2433255 (0.061)***	-0.2433754 (0.069)***
Share of population with postgraduate degrees	-0.1044227 (0.069)	-0.1044184 (0.068)
Log Unemployment rate	-4.494452 (1.292)***	-4.494105 (1.292)***
Log Population	0.981194 (0.476)**	0.9804514 (0.476)**
Log Population Density	1.005915 (0.411)**	1.007394 (0.411)***
Log Disposable Income	-4.742497 (1.981)**	-4.737101 (1.982)*
Country Gini coefficient	0.5077286 (0.166)***	0.5076455 (0.166)***
_constant	60.46325 (18.683)***	60.41184 (18.691)***

Sources: OECD, Centre for Cities, national statistic agencies.

7. Discussion

The analysis shows the impact of growth in cities in terms of income inequality. Higher population urban density growth means the city grows faster than the natural growth due to fertility rates, meaning it attracts people from other cities and rural areas. In previous sections, the relationship between urban-rural migration and income inequality was briefly discussed. Kuznets (1955) explained that urbanization brings inequality at early stages, due to the difference in skills and the inability to incorporate to the labor force easily. Saunders (2011) explains a theory of how cities develop given migration from rural areas and smaller cities.

However, migration flow to cities does not stop. Rather than being a phenomenon divided in stages, it is a continuous process. People flock to cities in waves that extend over large periods of time, sometimes in a continuous never-ending flow. Faster growing cities, with increasing numbers of migrants, will find it difficult to curb income inequality based on the skill difference assumption. However, these cities also attract talented people from the Creative Class, causing a significant impact on income inequality, segregation and poverty concentration (Florida, 2017).

The results of this analysis follow these ideas. Cities that have grown the most tend to be more unequal because they attract more people from other parts of the country, some of which have different skill levels, and they are constantly receiving these migrants. This does not mean that all will gain from moving to large metropolitan areas. Glaeser (2011) point that cities are paths to prosperity still stands however, income inequality and poverty still prevail in densely populated areas, even in the developed world because of ongoing migration.

The results also show that while larger cities like New York and London keep growing, smaller cities are growing faster. This is important to discuss because an increasing demand in living spaces in these relatively smaller cities can generate a big impact in income disparities. As discussed in the conceptual framework, migration can create an impact in labor and real estate markets, attracting high-skilled affluent people and pushing low-income households away. Uncontrolled and rapid growth may have a severe impact in segregation and poverty concentration.

Several caveats should also be discussed. Inequality in cities, as proved in the analysis, is also determined by the country's inequality. Structural issues like racism and segregation play a significant role in income disparities across geographic units. Countries like the United States and Canada both have particular problems with racial segregation in cities (Hanjal,

1995; Bolton and Breau, 2012) and this phenomenon can overshadow or exacerbate the migration dynamic explained in this research. People will still migrate to larger cities from smaller towns, and it is possible that structural racism has impacted the creation of these arrival cities, exacerbating inequalities.

The results from this analysis, and other studies of income inequality in cities, should be taken into consideration by policymakers in government and international organizations. Cities around the world will increase in population and while this might improve the lives of newcomers (Glaeser, 2011), this can also create negative consequences to a big portion of the population. This growth in income inequality within cities could impact people's access to health services, to high quality education, and jobs, severely limiting social mobility (Neckerman and Torche, 2007). Furthermore, political tensions may arise between prosperous and declining neighborhoods and cities. These tensions have already caused reversals of policies on a national level, labeled as effective and important for economic development, in the developed world (Rodríguez-Pose, 2018). Development policies will certainly focus increasingly on cities rather than on rural areas. Policymakers should be aware of potential consequences of urban growth in order to prevent income inequality. Furthermore, the vast majority of studies are done in developed countries, where data is available at city level. There is very little research on developing countries, where the problem of inequality and poverty is greater population growth in cities is higher, compared to developed countries (UN-DESA, 2018).

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