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The Impact of Urban Concentration on Economic Growth: An Empirical Investigation for a Sample of Countries

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ABSTRACT

Researchers have recently shown widespread interest in the urban concentrations and the resulting economic impacts on global cities. Opinions differ among researchers as some believe in the existence of such effect while the others do not. The study investigates the impact of urban concentration on economic growth by using panel data for 16 countries during 1970-2014. In order to verify the strength of the results, this paper uses two measures for urban concentration, namely urban primacy and urban density. Results show that urban concentration has a positive impact on economic growth and no evidence was found that support the non-linear effect of urban concentration on economic growth. This finding supports many previous empirical studies that highlight the importance of agglomeration economies on economic growth.

Keywords: Urban concentration, Externalities, Urban primacy, Urban density, Economic growth
JEL Classifications: O4, R11, R12

1. INTRODUCTION

In recent years, researchers have shown widespread interest in the urban concentrations and the resulting economic impacts that our cities witness. Opinions differ between those who believe that there is an impact of the urban concentration on economic growth and those who believe otherwise. Although there is no specific definition of the concept of "urban concentration," it can be understood as the degree of population concentration in urban areas. Moreover, by adopting the measures used in this field to give the concept a clearer definition, then it can be stated that it is the percentage of urban population living in the largest city, or the share of the urban population living in cities above a certain size (Frick and Rodriguez-Pose, 2018).

Cities generate more than 80% of global GDP (UN-Habitat, 2016), and their importance for the economy is concentrated on the economies of scale they provide besides the gains resulting from specialization at the levels of the industry and service sectors; as well as facilitating a better matching process between workforce skills and work requirements. Knowledge spillovers and patents among companies, mimicking and innovation in style are examples of external effects of production that are encouraged by urban concentrations. These effects may arise with spatial concentration by a specific sector (localization economies) or by greater concentrations of various sectors (urbanization economies), and all of which fall within the concept of "agglomeration economies" that provide in turn cost advantages to producers and consumers inside cities (Quigley, 2008; Todaro and Smith, 2012).

At the time of preparing this study, the outbreak of coronavirus (COVID-19) just started. Although the study does not cover the period of virus outbreak, this pandemic urges us to rethink over the pros and cons concerning urban concentration and its impact on economic growth. Hence, given the importance of this topic, this paper aims at estimating the impact of urban concentration on economic growth for a sample of 16 countries whose population size falls between (6) and (12) million inhabitants over the period 1970-2017. These countries are chosen based on data availability and regional coverage, globally speaking. The importance of the study is in examining the impact of urban concentration on economic growth through the adoption of two measures for urban concentration, urban primacy and urban density, in order to verify the strength of the results against changes in measures.

The paper is structured as follows: Section 2 discusses the forces and externalities behind urban concentration, Section 3 provides an overview of the literature that links urban concentration to economic growth, Section 4 discusses the impact of urban concentration on economic growth, Sections 5 and 6 focus on the model, data, and the empirical results. The paper ends with some concluding remarks.

2. URBAN CONCENTRATION: FORCES AND EXTERNALITIES

Researchers and experts in the fields of economic geography and urban economy have shown wide interest in urban concentrations and the resulting external effects. The literature also shows that the spatial balance of economic activities and individuals can be viewed as the outcome of two types of opposing forces: agglomeration (centripetal) and dispersion (centrifugal) forces (Fujita and Thisse, 1996). Krugman, who is considered one of the founders of New Economic Geography, asserts that urbanization and uneven regional development are the result of "centripetal" and "centrifugal" forces. The centripetal forces tend to pull population and production activities into agglomerations, while in return the centrifugal forces tend to break such agglomerations up (Krugman, 1995; 2010). In order to examine how urban concentrations affect economic growth, it is necessary to understand the opposing forces behind these concentrations in addition to the positive and negative externalities that accompany them as below discussed.

2.1. Agglomeration Forces and Positive Externalities

Most of the literature dealing with the concentration of individuals and industries in one place follows Alfred Marshall's ideas about the positive external economies resulting from industry localization, that is, those productive gains achieved by the concentration of several firms in a single location (Frick, 2017; Krugman, 1991). Positive external economies such as information spillovers, knowledge accumulation and economies of scale resulting from proximity to large markets create incentives for firms to locate close to each other. Additionally, combining consumer and intermediate goods markets is an important factor behind the agglomeration forces. Demand for manufacturing comes not only from final consumers, but also from intermediate demand. This, in turn, increases the demand for location that have a large number of firms because of their attractiveness for both, the intermediate producers, and the firms that use these goods, especially when the concentration in these locations reduces the transportation costs of the inputs and outputs of the production process. Consequently, the backward and forward linkages resulting from these urban concentrations consider as an incentive for agglomeration forces (Henderson et al., 2001).

Moreover, Krugman makes a list of the major types of centripetal forces that appear in various models of urban growth, and points out that all of these forces would explain the patterns of urbanization that countries take, especially the developing ones. Among the centripetal forces determined by Krugman are those related to the natural advantages of particular site, such as harbors, rivers and the like, in addition to the thick labor market and the external economies associated with the knowledge spillovers (Krugman, 1995). As far as environment is concerned, researches have also shown that the higher the urban density, the less energy is consumed for electricity and transportation (Albino et al., 2015).

On the other hand, virus outbreaks in recent years place under investigation another type of agglomerations that some cities witness today. In a very recent study Allam and David (2020) highlight the importance of smart cities in improving the health fabric of cities generally. The study points out that the vast array of technological products that smart cities have, might be able to facilitate early detection of pandemics and provide better urban decisions without minimal compromise on the urban economy.

2.2. Dispersion Forces and Negative Externalities

Urban concentrations is said to reinforce dispersion (centrifugal) forces that work against the agglomeration benefits, leading to disperse activities into other regions of the country (Frick, 2017). Among the dispersion forces are those related to immobile factors of production such as the land factor, as the prices of such factor bid up in a locations with high concentration of activities leading firms to move to a locations with lower cost for this factor (Henderson et al., 2001).

Likewise, negative externalities from congestion affect the reinforcement of dispersion forces along with the market extent (Henderson et al., 2001). Wheaton and Shishido (1981) point out that the degree of urban decentralization in any particular country depends on the scale economies, the market size, and the spatial diffusion of the market and hence, transportation costs. Thus, if the distribution of cities in a country follows the laws of economic efficiency, then large economies of scale should result in more urban concentration, while on the other hand, a larger and/or more dispersed market should lead to urban decentralization.

On the other hand, many sources claim that cities are responsible for large shares of global greenhouse gas emissions (Satterthwaite, 2008). Moreover, crime and violence are more pronounced in urban areas, than in rural settings. A report for the World Health Organization (2009) shows that cities may also become one of the factors that enhance the spread of diseases in today's world. With the outbreak of the current highly contagious disease of COVID-19, some populations strategies such as workplace social distancing and banning mass gathering are considered among the best disease containment. These features could be considered as negative externalities as they are associated with urban concentration in today's world.

3. URBAN CONCENTRATION AND ECONOMIC GROWTH

The literature of urban economic has begun to spread in the early 1960s, and in attempt to formalize the relationship between urban concentration and economic growth Williamson hypothesis of development was used (Williamson, 1965). Such hypothesis, also known as the bell-shaped hypothesis, states that economic development first increases and then decreases spatial concentration within a country, thus exhibiting a bell shaped relationship. According to Williamson hypothesis, at early stages of economic development, a high degree of urban concentration is essential to efficiency due to positive externalities, yet at later stages, urban concentration becomes less efficient for economic agents due to negative externalities (Bala, 2009). However, empirical evidence of the bell-shaped hypothesis has not been conclusive.

Henderson (2000, 3000) in his studies indicates that within a certain level of economic growth, there is an optimal level of urban concentration. Any deviation from this level would result in economic losses. This comes in line with the result of Castells-Quintana and Royuela (2015b) that uses urban concentration as a measure of urbanization and concludes that there is a non-linear relationship (Bell-shaped) between the spatial concentration and economic development. As for Bertinelli and Strobl (2003) the study also confirms the non-linear relationship between urban concentration and economic growth, analogous with Henderson (2003) but it obtained a U-shaped relationship instead of a bell-shaped between urban concentration and economic growth.

On the other hand, Petrakos (1992) concludes that the external agglomeration economies in the largest cities have been exhausted. Therefore he suggests that a meaningful policy aiming to alleviate the social costs of concentration in over-populated metropolises without reducing the overall efficiency of the economy, should follow a long term strategy of developing smaller cities and favoring the operation of smaller-scale, less capital-intensive enterprises in the economy. Moomaw and Shatter (1996) examine urban concentration through bias toward large cities, and conclude that the importance of large cities decreases in the more open economies, while urban primacy rates increase in countries with low GDP. Christiaensen and Todo (2013) find that agglomeration in mega cities is on average associated with faster growth and higher income inequality, while dispersion into secondary towns typically facilitates a more inclusive but slower, growth process. Therefore, when fostering overall economic growth is the primary objective, both public investment and policy choice should be shifted in favor of rapid urbanization and mega city development. However, when rapid poverty reduction is the main objective, more attention should be given to fostering rural diversification and secondary town development.

Recently, Frick and Rodriguez-Pose (2018) assess the impact of urban concentration on economic growth in developed and developing countries. The results show that there is a positive relationship between urban concentration and economic growth in the developed countries sample. As for developing countries, the results come to the contrary which are similar to Castells-Quintana (2015a) results. Castells-Quintana shows how urban concentration can be negatively associated with economic growth under environments with deficient urban infrastructure. He clarifies that the large agglomerations in developing countries, lead to congestion costs which exceed the benefits from agglomeration. On the other hand, the results also show a positive effect of the urban concentration on economic growth in developed countries.

4. THE IMPACT OF URBAN CONCENTRATION ON ECONOMIC GROWTH

To estimate the impact of urban concentration on economic growth, the empirical analysis of this paper is based on GDP per capita growth framework, following works such as Henderson (2003), Brulhart and Sbergami (2009), Castells-Quintana and Royuela (2014, 2013), and Frick and Rodriguez-Pose (2018). The neoclassical model of economic growth is the basis for most empirical growth work, as according to the neoclassical theoretical framework it is possible to analyze the economic growth process of country (i) as is shown in equation (1).

$$Y_i = g_i+\beta_i(\log y_{i,0}-\log y^E_{i,\infty}-\log A_{i,0}) \quad (1)$$

Where Y_i is output per capita average growth rate of country i for the period between 0 and t, $y_{i,0}$ is initial output per capita, $y^E_{i,\infty}$ is its steady-state value, $A_{i,0}$ is initial efficiency level or technology, and g_i is the steady-state growth rate. Thus, equation (1) decomposes the growth rate in country i into two distinct components. The first component, g_i, measures growth due to technological progress, whereas the second component β_i $(\log y_{i,0}-\log y^E_{i,\infty}-\log A_{i,0})$ measures growth due to the gap between initial output per capita and the steady-state value. It is to note here that the second source of growth represents "the convergence hypothesis," which assumes that countries with lower levels of income grow faster. Equation (2) shows the value of β_i, where the parameter λ_i represent the speed of convergence to the steady state (Castells-Quintana and Royuela, 2013: 2014; Durlauf et al., 2004).

$$\beta_i = -t^{-1}\ (1-e^{-\lambda it}) \quad (2)$$

Equation (1) can be rewritten to take the form of equation (3) but under the additional assumptions that the rates of technological progress and the parameters λ_i are constant across countries, i.e. $g_i = g$ and $\lambda_i = \lambda\ \forall$ i.

$$Y_i = g-\beta \log y^E_{i,\infty}-\beta \log A_{i,0}+\beta \log y_{i,0} \quad (3)$$

Equation (3) is the foundation of the empirical growth literature that was applied by cross-country growth regression, and once it is append to a random error term υ_i, the transition from theoretical work to econometric work begins, as shown in equation (4).

$$Y_i = g-\beta \log y^E_{i,\infty}-\beta \log A_{i,0}+\beta \log y_{i,0}+\upsilon_i \quad (4)$$

To implement equation (4), empirical analogs for $(\log y^E_{i,\infty})$ and $(\log A_{i,0})$ was developed based on Solow model for economic growth, in which $A_{i,0}$ was interpreted in a broader way that includes not only technology but other factors that affect economic growth such as: resource endowments, climate, institutions, characteristic of economic geography and other determinants. Equation (5) represents a generic representation of a growth regression model that is linear in variables.

$$Y_i = \beta \log y_{i,0} + \mu X_i + \pi Z_i + \epsilon_i \quad (5)$$

Where X_i is a constant and growth determinants that are suggested by the Solow growth model, Z_i is a vector of growth determinants that lie outside Solow's original theory which explains cross-country differences in growth, and ϵ_i is the error term. Equation (5) expanded to include other dimensions, such as panel data and non-linear regressions (Durlauf et al., 2004). As for the degree of urban concentration, it can be considered as one of the variables of the vector Z_i being a relevant determinant that would affect the efficiency of economic growth.

5. MODEL AND DATA

According to the theoretical and empirical frameworks discussed above the estimating equation takes the form of equation (6), where two measures for urban concentrations adopted: urban primacy and urban density.

$$GGDPP_{it} = \alpha_0 + \alpha_1 I_{it} + \alpha_2 G_{it} + \alpha_3 lnGDPP_{it-1} + \alpha_4 UC_{it} + \alpha_5 UC^2_{it} + \alpha_6 UR_{it} + \alpha_7 La_{it} + \mathcal{E}_{it} \quad (6)$$

Where
$GGDPP_{it}$: GDP per capita growth rate of country *i* in period *t*,
I_{it}: Private investment of country *i* in period *t*,
G_{it}: Share of government consumption of country *i* in period *t*,
$lnGDPP_{it-1}$: Lagged of natural logarithm of GDP per capita of country *i* in period *t*–1,
UC_{it}: urban concentration of country *i* in period *t*,
UC^2_{it}: Second order polynomials of urban concentration of country *i* in period *t*,
UR_{it}: Urbanization rate of country *i* in period *t*,
La_{it}: Ratio of land area of country *i* in period *t*,
α_0: Intercept,
$\mathcal{E}_{it}$: Error term.

In the choice of variables to be included in the regression model besides the variable of interest, this paper adopted general to specific approach, whereby two groups of variables included in the regression model. The first group includes variables that are generally included in the economic growth regressions (X_i in equation [5]) following works as Levine and Renelt (1992), Sala-i-Martin (1997), and Sala-i-Martin et al. (2000). These variables are: (a) In initial GDP per capita, the coefficient of this variable should be negative. According to the convergence hypothesis of neoclassical growth models, a country's per capita growth rate tends to be inversely related to its starting level of income per capita (Barro, 1991). For the panel data setting , and to control for conditional convergence hypothesis, the lagged of in GDP per capita is taken for this variable following works as Loayza (1994), Islam (1995), Kim (2005), and Brulhart and Sbergami (2009); (b) private investment; and (c) government consumption share. To satisfy the restrictions of economic theory, the coefficients of these two variables should be positive and negative respectively.

As for the second group, it includes variables that are more related to urban structure of the country (Z_i in equation [5]) and which are likely to affect economic growth following the works of Brulhart and Sbergami (2009), and Frick and Rodriguez-Pose (2018). These variables are: (a) Ratio of land area, this variable affects the urban structure of the country, as it is possible that small countries in terms of area will have fewer cities, which leads to greater urban concentrations. (b) Urbanization rate, In addition to the effect of this variable on the urban structure of the country, the difference in urbanization rates between countries may have an effect on the difference in the impact of urban concentration on economic growth (Castells-Quintana, 2015a).

For our main variables of interest are those that represent urban concentration. The first measure use to estimate the impact of urban concentration on economic growth is urban primacy, defined as the percentage of urban population living in the largest city. Primacy is an easy measure to use, as its data available over years for many countries. Moreover, this measure is convincing when there are no significant differences in the sizes of countries, and therefore it suits our sample countries. Additionally, this measure is widely use, as adopted in many previous studies, such as Henderson (2000, 2003), Bertinelli and Strobl (2003), Brulhart and Sbergami (2009), and Castells-Quintana (2015a). The second measure used is the share of the urban population living in cities above a certain size threshold, most prominently threshold used are either 750,000 or 1 million inhabitants (Frick and Rodriguez-Pose, 2018). Bertinelli and Strobl (2003) called this measure "urban density" and defined it as the share of the urban population living in cities larger than 750,000 inhabitants. As for this paper, it's follows Castells-Quintana and Royuela (2011) and defines this measure as the share of urban population living in cities larger than 1 million inhabitants, based on data availability, and it will adopt the name "urban density" for it.

Beyond the aspect of using two measures for the urban concentration, what distinguishes urban density from primacy is that there are often cities other than the largest city that account for large proportions of the urban population (Bala, 2009). Moreover, changes in primacy do not always reflect changes in the total population (Bertinelli and Stroble, 2003). To allow for a possible non-linear relationship between urban concentration and growth, we also add the second order polynomials for both primacy and urban density variables, following the works of Henderson (2003), Brulhart and Sbergami (2009), and Frick and Rodriguez-Pose (2018).

Econometric models will apply on a sample of 16 countries by using panel data for the years 1970-2017. Table 1 (appendix) shows data on the urban concentrations and population size of our sample countries that fall between (6) and (12) million inhabitants based on 2017 data. Real GDP per capita, private, and government investment are sourced from the Penn World Table, version 9.1 (Feenstra et al., 2015). Land area, urbanization rate, urban primacy and urban density are from the World Development Indicators. Table 2 (appendix) includes an overview of the specific variables used in the analysis and their data sources.

6. EMPIRICAL RESULTS

6.1. Panel Unit Root Tests

To examine the unit root properties of the panel data for spurious regressions check, the study apply Levin, Lin and Chu (LLC), and Im, Pesaran and Shin (IPS) tests for the variables under investigation. Table 3 (appendix) shows the results of unit root for both LLC and IPS tests at "level" and Table 4 (appendix) shows the results at the "first difference." For the level variables, the majority of the results cannot reject the null hypothesis of a unit root. However, after taking the first difference for the variables the null hypothesis of a unit root is rejected at the 5% level and for all LLC and IPS tests. Therefore, we can conclude that all the variables under study are unit root non-stationary at level and they become stationary at first difference.

6.2. Panel Cointegration Tests

Since all panel data are I(1) then become I(0) after taking the first difference, our next step is to investigate whether there is a long-term relationship among the variables. Two panel cointegration tests were conducted; the first one is the Pedroni Panel Cointegration test, and the second one is the Kao Panel Cointegration test. The results of the Pedroni test for the first model, which include urban primacy as a measure of urban concentration, are displayed in Table 5 (appendix), while the results of the second model having urban density as a measure of urban concentration are displayed in Table 6 (appendix). All the results of the Pedroni Panel Cointegration tests reject the null hypothesis of no cointegration for both models. The majority of the outcomes have a probability value less than 0.05 and for all assumptions that includes: Individual intercept, individual intercept and trend and no intercept or trend. As for the Kao tests, Table 7 (appendix) shows that the probability values for both models are less than 0.05 which leads to reject the null hypothesis of no cointegration. Therefore, it can be concluded that for each model in this study the non-stationary cointegrated variables have a long-term equilibrium relationship.

6.3. Estimation Results

Having a long-term stable relationship between variables for each model is an important indicator for meaningful non-spurious regressions. One of the most promising approaches in cointegrated panel regressions is the panel dynamic least squares (DOLS) method (Baltagi, 2005). According to Kao and Chiang (2000), DOLS performs very well in all cases for both the homogeneous and heterogonous panels. Tables 8 and 9 (appendix), show the results of DOLS for the first and second model respectively.

The two models work well and the regression coefficients of the first group of variables have the expected signs, which satisfy the restrictions of economic theory. Private investment is positive and statistically significant in both models. Government consumption is also significant with negative sign in both models, indicating for a possible crowding out effect with private investment. Natural logarithm of lagged GDP per capita is negative and highly significant in both models, showing that the output is converging among our sample countries, which proves the conditional convergence hypothesis. For the second group results of variables, the urbanization rate varies somewhat by model. In the first model, urbanization rate has a positive and significant coefficient while in the second model it is negative and insignificant. On the other hand, the ratio of the land area is negative and insignificant in both models.

Turning now to our variables of interest, in the first model where urban primacy uses as a measure of urban concentration, the coefficient is positive and statistically significant at 5% level. The squared term of the variable is negative but statistically insignificant. As for the second model, where urban density uses as an alternative measure for urban concentrations, the same results were obtained. The coefficient is positive but only statistically significant at 10% level. Moreover, the squared term of the variable is negative and statistically insignificant as well. This would suggest that urban concentration has a positive impact on economic growth for our sample countries, while no evidence supports non-linear effects, as squared terms of both urban primacy and urban density are statistically insignificant.

7. CONCLUSIONS

This study investigates the impact of urban concentration on economic growth by using panel cointegrated regression techniques. For non-stationary cointegrated variables panel DOLS estimation used to estimate the long-term relationship between urban concentration and economic growth. In exchange for verifying the strength of the results, this paper uses two measures for urban concentration, namely urban primacy and urban density. The estimated main impacts of urban primacy and urban density on economic growth are positive and statistically significant indicating that both measures are appropriate indices for urban concentration. Additionally, the findings also emphasized the importance of urban concentration on economic growth, which supports many previous empirical studies that highlight the importance of agglomeration economies on economic growth.

Although the findings indicate that urban concentration contributes positively to economic growth, this may have been resulted from the fact that urban concentrations in these economies are the economic centers in which all industrial and commercial activities are concentrated and thus contribute positively to its economies and this may explain also why the measure of urban primacy (as the largest city within the economy) is more significant than urban density in the findings of this study. It is a fact that most of firms concentrate themselves where there are workers and consumers. On the other hand, people concentrate themselves where there are jobs and facilities. Therefore, caution should be taken not to over or underestimate the impact of urban concentration on economic growth, especially at the present time where the outbreak of COVID-19 pose a real threat to large cities and after taking into consideration all the positive and negative externalities that are associated with urban concentration.

REFERENCES

Albino, V., Berardi, U., Dangelico, R.M. (2015), Smart cities: Definitions, dimensions, performance, and initiatives. Journal of Urban Technology, 22(1), 3-21.

Allam, Z., David, J. (2020), On the coronavirus (COVID-19) outbreak and the smart city network: Universal data sharing standards coupled with artificial intelligence (AI) to benefit urban health monitoring and management. Healthcare, 8, 46.

Bala, A.P. (2009), Urban Concentration and Economic Growth: Checking for Specific Regional Effects. Prayagraj: CORE Discussion Papers 2009/38.

Baltagi, B.H. (2005), Econometric Analysis of Panel Data. 3rd ed. England: John Wiley & Sons Ltd.

Barro, R.J. (1991), Economic growth in a cross section of countries. Quarterly Journal of Economics, 106(2), 407-443.

Bertinelli, L., Strobl, E. (2003), Urbanization, Urban Concentration and Economic Growth in Developing Countries. Prayagraj: CORE Discussion Paper 2003/76.

Brulhart, M., Sbergami, F. (2009), Agglomeration and growth: Cross-country evidence. Journal of Urban Economics, 65(1), 48-63.

Castells-Quintana, D. (2015a), Malthus Living in a Slum: Urban Concentration, Infrastructures and Economic Growth. AQR-IREA Working Paper no. 2015/05. Barcelona: Regional Quantitative Analysis Group.

Castells-Quintana, D., Royuela, V. (2011), Agglomeration, Inequality and Economic Growth. IREA Working Papers 201114. Spain: University of Barcelona, Research Institute of Applied Economics.

Castells-Quintana, D., Royuela, V. (2013), Urban Concentration and Economic Growth: The Role of Urban Infrastructures. Preliminary Version. Available from: http://www.uea.ac.uk/documents/425303/4065543. [Last accessed on 2019 Jan 21].

Castells-Quintana, D., Royuela, V. (2014), Malthus Living in a Slum: Urban Concentration, Infrastructures and Economic Growth. Berlin, Germany: ERSA Conference Papers, European Regional Science Association.

Castells-Quintana, D., Royuela, V. (2015b), Are increasing urbanisation and inequalities symptoms of growth? Applied Spatial Analysis, 8(3), 291-308.

Christiaensen, L., Todo, Y. (2013), Poverty Reduction During the Rural-urban Transformation the Role of the Missing Middle, Policy Research Working Paper, No. WPS6445. United States: World Bank.

Durlauf, S.N., Johnson, P.A., Temple, J.R.W. (2004), Growth Econometrics. Wisconsin: University Of Wisconsin.

Feenstra, R.C., Robert, I., Marcel, P.T. (2015), The next generation of the Penn world table. American Economic Review, 105(10), 3150-3182, Available from: http://www.ggdc.net/pwt.

Frick, S. (2017), Urban Structure, Location of Economic Activity and Aggregate Growth: Empirical Evidence and Policies, Doctoral Dissertation. England: The London School of Economics and Political Science.

Frick, S.A., Rodriguez-Pose, A. (2018), Change in urban concentration and economic growth. World Development, 105, 156-170.

Fujita, M., Thisse, J.F. (1996), Economics of agglomeration. Journal of the Japanese and International Economies, 10(4), 339-378.

Henderson J.V., Shalizi, Z., Venables, A.J. (2001), Geography and development. Journal of Economic Geography, 1(1), 81-105.

Henderson, J.V. (2003), The urbanization process and economic growth: The so-what question. Journal of Economic Growth, 8(1), 47-71.

Henderson, J.V. (2000), How Urban Concentration Affects Economic Growth, Policy Research Working Paper Series 2326. United States: World Bank.

Islam, N. (1995), Growth empirics: A panel data approach. The Quarterly Journal of Economics, 110(4), 1127-1170.

Kao, C., Chiang, M.H. (2000), On the estimation and inference of a cointegrated regression in panel data. Advances in Econometrics, 15, 179-222.

Kim, J. (2005), Convergence hypothesis of regional income in Korea. Applied Economics Letters, 12, 431-435.

Krugman, P. (1991), Increasing returns and economic geography. Journal of Political Economy, 99(3), 483-499.

Krugman, P. (1995), Urban Concentration: The Role of Increasing Returns and Transport Costs. Washington, DC: The World Bank.

Krugman, P. (2010), The New Economic Geography, Now Middle Aged. Washington, DC: Paper Prepared for Presentation to the Association of American Geographers Meetings.

Levine, R., Renelt, D. (1992), A sensitivity analysis of cross-country growth regressions. American Economic Review, 82(4), 942-963.

Loayza, N.V. (1994), A Test of the International Convergence Hypothesis Using Panel Data, Policy Research Working Paper No. 1333. United States: The World Bank.

Moomaw, R.L., Shatter, A.M. (1996), Urbanization and economic development: A bias toward large cities? Journal of Urban Economics, 40, 13-37.

Petrakos, G.C. (1992), Urban concentration and agglomeration: Re-examining the relationship. Urban Studies, 29(8), 1219-1230.

Quigley, J.M. (2008), Urbanization, Agglomeration, and Economic Development, Commission on Growth and Development, Working Paper Series No. 19. Washington, DC: World Bank.

Sala-i-Martin, X. (1997), I Just Ran Four Million Regressions, NBER Working Paper 6252. United States: National Bureau of Economic Research, Inc.

Sala-i-Martin, X., Doppelhofer, G., Miller, R.I. (2000), Determinants of Long-term Growth: A Bayesian Averaging of Classical Estimates (BACE) Approach. NBER Working Paper 7750. United States: National Bureau of Economic Research, Inc.

Satterthwaite, D. (2008), Cities' contribution to global warming: Notes on the allocation of greenhouse gas emissions. Environment and Urbanization, 20(2), 539-550.

Todaro, M.P., Smith, S.C. (2012), Economic Development. 11th ed. United States: Pearson Addison Wesley.

UN-Habitat. (2016), World Cities Report 2016-urbanization and Development: Emerging Futures. Nairobi: UN-Habitat.

Wheaton, W.C., Shishido, H. (1981), Urban concentration, agglomeration economics and the level of economic development. Economic Development and Cultural Change, 30(1), 17-30.

Williamson, J.G. (1965), Regional inequality and the process of national development: A description of the patters. Economic and Cultural Change, 13, 1-84.

World Health Organization. (2009), Cities and Public Health Crises, Report of the International Consultation. Lyon, France: World Health Organization.

APPENDIX

Table 1: Population size and urban concentrations for sample countries (year 2017)*

Country	Population	Urban concentration	
		Urban primacy	Urban density
Tunisia	11,433,443	28.72	19.72
Belgium	11,375,158	18.25	26.91
Greece	10,754,679	37.29	29.36
Bolivia	11,192,854	23.16	41.08
Dominican Republic	10,513,131	36.67	29.43
Portugal	10,300,300	43.74	40.94
Sweden	10,057,698	17.72	15.44
Hungary	9,787,966	25.23	17.93
Jordan	9,779,173	22.16	20.11
United Arab Emirates	9,487,203	32.40	57.55
Honduras	9,429,013	24.76	13.98
Austria	8,797,566	36.75	21.35
Switzerland	8,451,840	21.75	16.04
El Salvador	6,388,122	24.25	17.28
Nicaragua	6,384,855	27.96	16.30
Paraguay	6,867,062	74.47	45.65

*Data source: World development indicators

Table 2: Variables definitions and data sources

Variable	Definition		Source
GDP per capita	Natural logarithm of (real GDP at constant 2011 national prices (in mil. 2011US $) "/" population)		Penn World Table, version 9.1
Private investment	Share of gross capital formation at current PPPs		(Feenstra et al., 2015)
Government consumption	Share of government consumption at current PPPs		World development indicators
Ratio of land area	Land area (sq. km) "*" %100 "/" Σ Land area	Land area is a country's total area, excluding area under inland water bodies, national claims to continental shelf, and exclusive economic zones	
Population	Total population is based on the de facto definition of population, which counts all residents regardless of legal status or citizenship		
Urbanization rate	Urban population (% of total population)		
Urban primacy	Population in the largest city (% of urban population)		
Urban density	Population in urban agglomerations of more than 1 million (% of total population)		

Table 3: Unit root tests at "level"

Variables	Levin, Lin and Chu			Im, Pesaran and Shin	
	IE	IE and T	N	IE	IE and T
lnGDPP	–4.62314* (0.0000)	3.54519 (0.9998)	14.6074 (1.0000)	0.84433 (0.8008)	0.61782 (0.7317)
I	–0.59516 (0.2759)	0.97243 (0.8346)	–1.48911 (0.0682)	–3.35321* (0.0004)	–1.06116 (0.1443)
G	–0.00776 (0.4969)	2.26203 (0.9882)	0.06417 (0.5256)	–1.42419 (0.0772)	0.24003 (0.5948)
UP	2.57234 (0.9949)	–0.79102 (0.2145)	–6.42026* (0.0000)	0.50762 (0.6941)	–3.67187* (0.0001)
UD	–0.45642 (0.3240)	0.40536 (0.6574)	11.2835 (1.0000)	1.44222 (0.9254)	–2.61730* (0.0044)
UR	–0.86453 (0.1936)	0.93920 (0.8262)	14.8103 (1.0000)	2.37251 (0.9912)	0.99924 (0.8412)
La	3.89162 (1.0000)	1.41746 (0.9218)	–3.63490* (0.0001)	1.78313 (0.9627)	1.75687 (0.9605)

The numbers in parentheses are the prob. values of the tests. IE: Represent test with individual effects, IE&T: Represent test with individual effects and individual linear trends, and N: Represent test with none of them. *Reject the null hypothesis, statistically significant at 5%

Table 4: Unit root tests at "1st difference"

Variables	Levin, Lin and Chu			Im, Pesaran and Shin	
	IE	IE and T	N	IE	IE and T
lnGDPP	–14.1545* (0.0000)	–13.9215* (0.0000)	–14.6722* (0.0000)	–11.8656* (0.0000)	–10.6753* (0.0000)
I	–9.18837* (0.0000)	–5.20726* (0.0000)	–27.7210* (0.0000)	–18.2592* (0.0000)	–19.1228* (0.0000)
G	–15.9627* (0.0000)	–14.5936* (0.0000)	–20.5929* (0.0000)	–11.7454* (0.0000)	–9.75071* (0.0000)
UP	–4.02130* (0.0000)	–2.95480* (0.0016)	–7.90717* (0.0000)	–4.50609* (0.0000)	–2.32250* (0.0101)
UD	–2.87195* (0.0020)	–2.23899* (0.0126)	–5.97908* (0.0000)	–3.75804* (0.0001)	–1.81980* (0.0344)
UR	–2.79779* (0.0026)	–2.84238* (0.0022)	–1.93942* (0.0262)	–3.44983* (0.0003)	–2.79407* (0.0026)
La	–8.09151* (0.0000)	–11.8044* (0.0000)	–9.23365* (0.0000)	–7.40361* (0.0000)	–6.52069* (0.0000)

The numbers in parentheses are the prob. values of the tests. IE: Represent test with individual effects, IE and T: Represent test with individual effects and individual linear trends, and N: Represent test with none of them. *Reject the null hypothesis, statistically significant at 5%

Table 5: Pedroni residual cointegration test for the first model (with urban primacy)

Within– dimension	Individual intercept		Individual intercept and trend		No intercept or trend	
	W.S.	P-value	W.S.	P-value	W.S.	P-value
Panel v– statistic	2.171129	0.0150	1.511203	0.0654	1.446311	0.0740
Panel rho– statistic	–1.100279	0.1356	0.191552	0.5760	–2.194035	0.0141
Panel PP– statistic	–4.181719	0.0000	–4.987686	0.0000	–5.088145	0.0000
Panel ADF– statistic	–3.641243	0.0001	–4.813391	0.0000	–4.085135	0.0000
Between– dimension	**Statistic**	**P-value**	**Statistic**	**P-value**	**Statistic**	**P-value**
Group rho– statistic	–0.488822	0.3125	0.768928	0.7790	–1.776847	0.0378
Group PP– statistic	–5.092682	0.0000	–6.603468	0.0000	–6.578388	0.0000
Group ADF– statistic	–3.715731	0.0001	–4.566443	0.0000	–4.577731	0.0000

W.S.: Stand for weighted statistic

Table 6: Pedroni residual cointegration test for the second model (with urban density)

Within- dimension	Individual intercept		Individual intercept and trend		No intercept or trend	
	W.S.	P-value	W.S.	P-value	W.S.	P-value
Panel v- statistic	2.251011	0.0122	1.526737	0.0634	1.530229	0.0630
Panel rho- statistic	–1.007326	0.1569	0.092232	0.5367	–2.163283	0.0153
Panel PP- statistic	–4.181563	0.0000	–4.835096	0.0000	–5.117895	0.0000
Panel ADF- statistic	–3.686151	0.0001	–4.568464	0.0000	–4.189720	0.0000
Between- dimension	**Statistic**	**P-value**	**Statistic**	**P-value**	**Statistic**	**P-value**
Group rho- statistic	–0.383015	0.3509	0.758864	0.7760	–1.706909	0.0439
Group PP- statistic	–4.986276	0.0000	–6.584618	0.0000	–6.637223	0.0000
Group ADF- statistic	–3.810603	0.0001	–4.353741	0.0000	–4.708538	0.0000

W.S.: Stand for weighted statistic

Table 7: Kao residual cointegration test

The model	t-statistic	Prob. value
Fist model (with urban primacy)	–8.138007	0.0000
Second model (with urban density)	–8.061811	0.0000

Table 8: Panel DOLS first model results. Dependent variable: GDP per capita growth rate 1970-2017

Variables	Coefficient	Std. Error	t-statistic	Prob.
Private investment	0.166871***	0.032077	5.202140	0.0000
Government consumption	–0.167206***	0.042506	–3.933683	0.0001
Ln (lagged GDP per capita)	–0.042855***	0.007143	–5.999312	0.0000
Urban primacy	0.004151**	0.001858	2.233774	0.0258
Urban primacy squared	–2.337137	1.882588	–1.241449	0.2149
Urbanization rate	0.001236***	0.000404	3.056496	0.0023
Ratio of land area	–0.002366	0.067779	–0.034914	0.9722

Observations - 723
R-squared - 0.207
***Prob<1%, **prob<5%, *prob<10%.

Table 9: Panel DOLS second model results. Dependent variable: GDP per capita growth rate 1970-2017

Variables	Coefficient	Std. Error	t-statistic	Prob.
Private investment	0.164307***	0.031665	5.188912	0.0000
Government consumption	–0.163648***	0.042138	–3.883617	0.0001
Ln (lagged GDP per capita)	–0.039837***	0.006661	–5.980769	0.0000
Urban density	0.003930*	0.002181	1.801710	0.0720
Urban density squared	–2.740072	3.151217	–0.869528	0.3849
Urbanization rate	–0.000279	0.000327	–0.853163	0.3939
Ratio of land area	–0.015546	0.070564	–0.220312	0.8257

Observations - 723
R-squared - 0.202
***Prob<1%, **prob<5%, *prob<10%.