Effects of Human and Economic Development on the Population Dynamics of Megacity: from the Perspective of Urban Dream

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Abstract

The Rank/Size rule (Zipf's law) implies that the bigger the city, the more attractive the city. And, the difference of population growth in megacities all over the world implies that attraction of Asian megacities is greater than Western megacities. This research adds the "urban dream" factor into the push-and-pull theory for city formation, and because most of the "urban dream" comes from poverty, this research proposes that the intensity of urban dream is a decreasing function of human and economic development, thus the intensity of urban dream will be bigger in Asia, consequently the push-and-pull model with urban dream factor can explain the differences between Eastern and Western megacities.

Key words: migration; megacity; urban dream; city size.

1. Introduction

As the extent of urbanization expands over time, more and more people live in the so-called "city". Regarding to the theory of city formation and size, in general, the advantages of city, such as economies of scale, economies of agglomeration, are thought to be the drivers of urban growth. On the other hand, the increasing cost accompanying population growth suppresses the expansion of city (Geltner et al., 2007).

Even though the formation and size of city can be explained from the perspective of economies of scale and agglomeration, the existence of megacities in which population are over ten millions still arose many discussions.

Table 1 is the rank, location and population dynamics of all megacities in the world. We can find some interesting differences between West and East. First, there are 35 megacities which populations are over ten million around the world in 2018, while 20 of them locate in Asia. And the 8 biggest megacities, namely, Guangzhou, Tokyo, Jakarta, Shanghai, Delhi, Manila, Seoul, and Bombay are all in Asia. Second, from the temporal perspective, except very highly developed Tokyo and Seoul, the Asian megacities, such as Guangzhou, Shanghai, Beijing and Tientsin in China; Jakarta in Indonesia; Delhi, Bombay, Calcutta and Bangalore in India; Karachi in Pakistan; Dhaka in Bangladesh etc., the populations in these megacities increase along with economic growth until now. However, the population in Western megacities, like New York and London, stay at a relatively stable level. Intuitively the population dynamics of megacity is related to economic development.

Besides, in general, the population density of Asian cities is greater than that of European and North American cities (Tan et al., 2008).

These phenomena remind us intuitively that we seem to neglect some implicit factor for urban growth, and the factor is stronger in Asia than that in Europe and North America. This research attempts to explain the persistent growth of Asian megacity population by adding the "urban dream" factor into the residents' utility function. Since the desire of "dream pursuing" (or "making big money") is part of Asian traditional cultures (especially in China) and have been cultivated from childhood, and many individuals think that the metropolitan area is a place with much more opportunities to make these dreams come true, thus the virtual connection between "success" and "metropolitan" reinforces their intention of moving into big city. And the cultural explanation can illustrate the variation of population dynamics between Eastern and Western megacities.

Table 1 The Rank, Location and Population Dynamics of Megacities in the World

Rank	Megacity	Country	Continent	Population (Growth rate / year)
1	Guangzhou	China	Asia	45,600,000 (2%)
2	Tokyo	Japan	Asia	39,900,000 (0.25%)
3	Jakarta	Indonesia	Asia	30,300,000 (3.2%)
4	Shanghai	China	Asia	29,500,000 (1.5%)
5	Delhi	India	Asia	28,400,000 (3.3%)
6	Manila	Philippines	Asia	24,600,000 (2.2%)
6	Seoul	Korea (South)	Asia	24,600,000 (0.5%)
8	Bombay	India	Asia	24,200,000 (1.9%)
9	Mexico City	Mexico	North America	22,600,000 (1%)
10	New York	United States of America	North America	22,200,000 (0.5%)
11	São Paulo	Brazil	South America	22,100,000 (1.3%)
12	Beijing	China	Asia	20,000,000 (2%)
13	Dacca	Bangladesh	Asia	18,800,000 (3.5%)
14	Bangkok	Thailand	Asia	18,400,000 (3.5%)
15	Cairo	Egypt	Africa	18,200,000 (2.4%)
15	Lagos	Nigeria	Africa	18,200,000 (3.2%)
17	Los Angeles	United States of America	North America	17,700,000 (0.75%)
17	Osaka	Japan	Asia	17,700,000 (-0.05%)
19	Moscow	Russia	Europe	17,000,000 (1%)
20	Karachi	Pakistan	Asia	16,900,000 (2.5%)
21	Calcutta	India	Asia	16,400,000 (1.2%)
22	Buenos Aires	Argentina	North America	16,100,000 (1.1%)
23	Istanbul	Turkey	Europe or Asia	14,800,000 (1.9%)
24	Tehran	Iran	Asia	14,700,000 (2.1%)
25	London	Great Britain	Europe	14,600,000 (1.1%)
26	Johannesburg	South Africa	Africa	13,400,000 (2%)
27	Rio de Janeiro	Brazil	South America	12,800,000 (0.6%)
28	Tientsin	China	Asia	12,700,000 (3.8%)
29	Lahore	Pakistan	Asia	12,200,000 (3.5%)
30	Kinshasa	Congo (Dem. Rep.)	Africa:	11,600,000 (3.5%)
31	Bangalore	India	Asia	11,500,000 (4%)
32	Paris	France	Europe	11,300,000 (0.5%)
33	Madras	India	Asia	10,700,000 (2.8%)
34	Nagoya	Japan	Asia	10,500,000 (0.1%)
35	Lima	Peru	South America	10,300,000 (1.6%)

Source：Thomas Brinkhoff: The Principal Agglomerations of the World. (Reference date: 2018-01-01)

In order to seek empirical supports of the "urban dream" effects, this research proposes that the intensity of urban dream is a decreasing function of human and economic development due to most of the "urban dream" comes from poverty; In addition, the intensity of urban dream is a decreasing function of rich-poor gap in the city, that is, little rich-poor gap in the city let people think they have better chance to be successful in the metropolitan.

The remainder of this paper is organized as follows: Section two discusses the effect of "urban dream" on the traditional push-and-pull theory; section three builds the regression model to test the proposition regarding "urban dream"; section four is the empirical results; and section five concludes.

2. Rank/Size rule (Zipf's law) in City Size Distribution

There are two paradigms regarding city formation and size. One is the competitive model of large-scale land developers operating in national land markets, and the other is the self-organization model of agglomeration (Henderson and Becker, 2000). Researchers usually utilize the economies of agglomeration and scale to explain the huge population in big cities (Moomaw, 1981; Henderson, 1986; Cervero, 2001; Au and Henderson, 2006). However, with regard to the dynamics of urban population growth, we still have some problems (Tan et al., 2008).

For example, the population distribution of cities all over the world usually shows a regular pattern of pyramid. That is, many small towns, fewer large towns, even fewer cities, and a small number of major metropolitan areas (McDonald and McMillen, 2010). The phenomenon is known as the "rank-size rule", that is $P_i=P_1/i$, P_1 is the population in the biggest city; here P_i is the population of ranked i city. The rank-size rule is a special case in the generalized "Zipf's rule". The generalized "Zipf's rule" is written as $Pi=Kia$, K is a constant which roughly equal to P_1; and a is a number near minus one (Marshall, 2007).

Most researches regarding this issue in urban economics support the validity of rank-size rule of city (Marshall，2007). [1] The rank-size rule implies that the bigger the city, the more attractive the city. However, researchers still have many questions about why the pyramid pattern exists in urban development (Geltner et al., 2007).

From the perspective of dynamic urban growth, the city size is affected by many factors. These factors could be categorized into two parts. One part is about the characteristics of the city itself, and the other part comes from the surrounding area of the city.

The characteristics of the city itself, such as the infrastructure, institution of taxing,

1 Soo (2007) is an example that does not support the validity of Zipf's rule. Soo（2007）utilized the demographic statistic of Malaysia in 1957, 1970, 1980, 1991, and 2000 to test the validity of Zipf's law. All empirical results do not confirm the Zipf's law except the result of 1957.

each kinds of living cost, the economies of agglomeration and scale, etc. will affect the migration. With regard to the influences of the surrounding area, most of them are due to the pressure of rural poverty. Figure 1 shows the concept of dynamic urban growth and the factors affecting city size. And the content of factors is illustrated as follows:

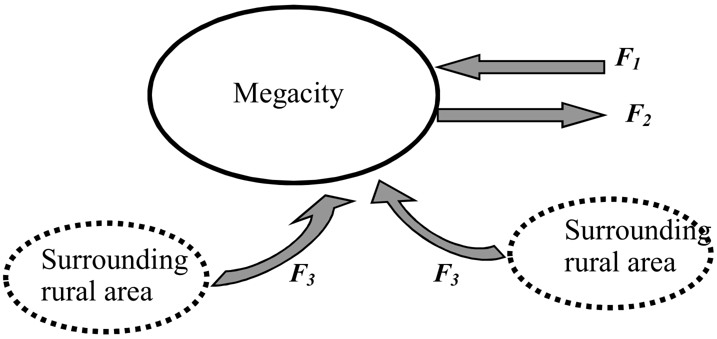

Figure 1. The Driving Forces for City Population Growth

2.1 The Effects of City Characteristics on City Population Growth:

(1) Positive effects on city population growth (or the centripetal force for population growth. (F_1 in Figure 1)[2]：

a. Economies of scale: If the fixed cost of production is invariable, thus the way of mass production in city will reduce the average cost of production.

b. Economies of agglomeration: When the similar firms cluster together, they usually can reduce the cost of production effectively. There are two types of economies of agglomeration. One type is vertical linkage which means the combination of upstream and downstream firms; the other type is horizontal linkage which generates synergy by sharing know-hows between firms in similar field.

c. Positive locational externalities: It implies that the firms can get some benefits with no cost from some actions of neighboring factories. The positive locational externalities are different from the economies of agglomeration, it usually happens between some firms nearby (Geltner et al., 2007).

(2) Negative effects on city population growth (or the centrifugal force for population growth. (F_2 in Figure 1)：

The centrifugal force for city population growth includes congestion, pollutions, crimes, high intra-urban transportation costs, and high rent and urban-land cost,

2 Compared to the "push factor" for city population growth which comes from surrounding rural region, the economic characteristics of the city itself for promoting urban growth are sometimes called the "pull factor" for urban growth (McDonald and McMillen, 2010).

etc. (Geltner et al., 2007). In general, the negative effects on city population growth will increase along with the expansion of city (Brueckner and Zenou, 1999; Brueckner and Kim, 2001; Cervero, 2001; Decker et al., 2007; Liu et al., 2010).

2.2 The Effects of Surrounding Rural Area on City Population Growth:

If the land in rural region could not provide enough products to satisfy the basic needs of people, people will be forced by the rural poverty to migrate into the city to pursue a better chance of living (F_3 in Figure 1). Due to the weakness of socio-economic conditions, those people could not afford the high living cost of the city. Therefore, they usually live in the slums or on the boundary of city (Mak et al., 2007; Grant, 2008; Pyne and German, 2009; McDonald and McMillen, 2010).

2.3. The Effect of Urban Dream on the Population Size of Megacities

Based on the interactions of factors for city population growth, it is intuitive that the sum of F_1, F_2, and F_3 in Figure 1 will decide the direction and magnitude of city population growth. In other words, the change dynamics of city population size is the reflection of relative strength of F_1, F_2, and F_3. Since F_1, F_2, and F_3 are all functions of city population size, thus we can find an equilibrium city size in which the sum of F_1, F_2, and F_3, is zero in theory.

As shown in Figure 2, in the beginning of city formation, the positive factors for city population growth (F_1+F_3) are greater than the negative factors (F_2), thus the city population size will expand over time. On the one hand, the positive factors for city population growth might increase along with the expansion of population; on the other hand, the negative factors which compress population growth could increase even more sharply. In theory, if the strength of positive factors equals to the negative factors, that is, $F_1+F_3=F_2$, thus the city population size will reach a stable equilibrium S in Figure 2.

For sure the equilibrium of city population size depends on some exogenous conditions, such as the commuting system, the construction technology for higher buildings, and the tools of communication, etc. The improvement of these exogenous conditions will increase the equilibrium city population size. But we have to note that the improvement of these exogenous conditions is not unlimited. In other words, although the new techniques for promoting compact city could progress continuously, we still could expect that the population of city has a maximum value. In the dynamic process of urban expansion, if the population of city overshoots its equilibrium value, then the negative factors for urban growth, for example, the unaffordable living cost and the environmental disamenities will force some residents to move out of city. It means that the equilibrium of city size in Figure 2 is a stable one.

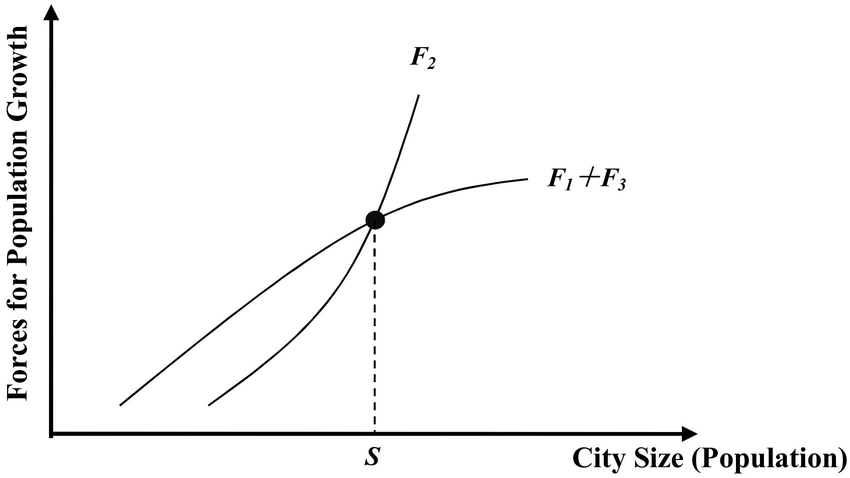

Figure 2 The Static Equilibrium of City Population Size

Note: F_1: Centripetal force for city population growth
F_2: Centrifugal force
F_3: Effect of rural poverty

Since individuals' migration choice influences the city size and population density, and the migration decision is affected by many social factors, including cultural background, historic tradition, and the policies of government (Tan et al., 2008). The policy factor may play a very important role in the Asian cities. For instance, the policy of "dynamic balance of arable land" in China promotes more compact use of urban land, increases the population density of city effectively (Tan et al., 2008). Most researches regarding urban affairs agree that the growth-management policy could contribute to the prevention of urban sprawl and control the pattern of urban development (Chan et al., 2002; Alig et al., 2004; Frenkel, 2004; Chen and Jia, 2005; Tan et al., 2008; Liu et al., 2010).

Although the policy of government could affect individuals' migration, it cannot be neglected that the effects of policy depend on the characteristics of individual. In other words, because of the different cultural backgrounds, the same policies may have different effects. This paper indicates that the F_1, F_2, and F_3 in Figure 2, will have different strength of effects on individuals with different characteristics. This thought could help us to understand the differences of Eastern and Western megacities.

Since that 20 of the 35 megacities, including the top eight, are located in Asia, and among the 20 urban areas with the highest population density in the world, eight are located in mainland China (Tan et al., 2008). It implies that we maybe underestimate the attraction power of city toward individuals in these Asian cities. In other words, Based on the premise of free migration of residents, and we also know that many residents live in the slums or border areas of these cities (Pyne and German, 2009; Brand, 2009), we can infer that, in Asia, we might underestimate the willingness of people to migrate into city (F_3 in Figure 1), and overestimate the negative effects resulting from high living cost and environmental disamenities (F_2 in Figure 1). Why? Perhaps is due to the cultural background and the relatively poor economic condition in Asia.

Compared to the individualism and pursuing diverse achievements in Western society, in eastern traditional culture, most people emphasizes the harmony of groups, and the definition of "success" is much narrower. In general, an individual will be called a successful guy if he can make a lot of money, thus the intensity of desire of making money is greater in Asia. Even children are educated that their success is a kind of symbol of filial obedience (Salili, 1996; Ji, 2008; Hofer et al., 2010). The strong desires of being rich for individuals, especially for the weak socio-economic condition individuals, the desire make them have higher durability to face the unfriendly urban environment.

For people with strong motive to pursue dreams in metropolitan areas, the negative effect of F_2 on them is relatively smaller, and the positive effect of F_3 is relatively bigger. Therefore, in these countries in which people are with stronger motive of dream pursuing, the equilibrium of city population size will be bigger than expected. The phenomenon can be illustrated in Figure 3.

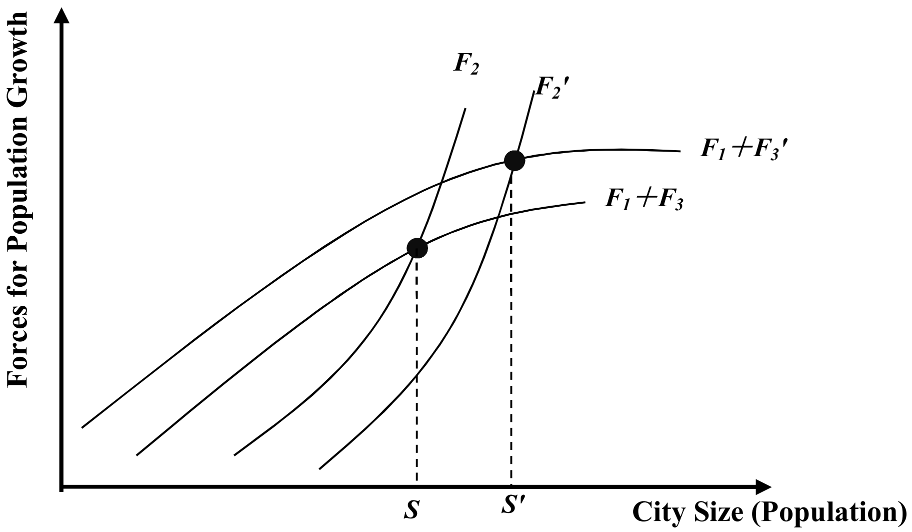

Figure 3 The Effect of Urban Dream on the Forces for Urban Population Growth

Note: F_1: Centripetal force for city population growth
F_2: Centrifugal force
F_2': Centrifugal force with "urban dream"
F_3: Effect of rural poverty
F_3': Effect of rural poverty with "urban dream

3. The Relationship between Human Development, Economic Situation, and Population Size in Megacities

In relation to the theories of city size and migration, most models suppose that the purpose of individual's migration is to increase their utility level. Individuals will not migrate while they have the same utility value in every region. Thus the equilibrium of migration is reached. In the meantime, the city size is fixed in a specific level.

In previous section, we know that the positive and negative factors for city population growth. It is notable that the nature of these factors which could affect people's migration is these factors can influence their utility levels. Naturally, the city population growth forces F_1, F_2, and F_3 in Figure 1 will have different impacts on individuals with different socio-economic conditions.

In order to explain the variation in population dynamics between Eastern and Western megacities, intuitively we can add the "urban dream" factor into individual's utility function, that is, if we set up the utility function of individuals as the form $U=U(D, X)$. D represents the "urban dream" factor, and X is other attributes which could affect individuals' utility level. This paper proposes that the utility function is an increasing function of "urban dream", that is, the individual's utility level will be higher as the intensity of "urban dream" increases with the X is kept at a fixed level.

In many of Asian countries, the effect of "urban dream" on individuals' migration always appear in informal literature, TV shows, and movies (Berry, 2009), such as the very famous Chinese movie entitled "Comrades, almost a love story" (directed by Ke-xin Chen, 1996); the documentary film "My fancy high heels" produced by Chao-ti Ho; and the series of reports about Dhaka (Capital of Bangladesh) at the GlobalPost website (Pyne and German, 2009). These kinds of films describe precisely the role of urban dream in the mood of typical immigrants who come from poverty rural areas. These immigrants live in the metropolitan, not only for pursuing a basic job, but also pursuing their dreams of success. The desires in the bottom of immigrants' hearts deserve more studies.[3]

The modern society is not friendly enough to those low-educated immigrants (Lin, 2005). If the marginal labors with weak socio-economic condition are forced or attracted to move into the city for better job, they usually cannot get what they want. However, compared to the poor rural areas, at least, in the metropolitan, at least there are many low-end jobs can satisfy their basic needs (Wu, 2008; Pyne and German, 2009). Besides, the metropolitan provides the space for their dreams (Chang and Hu, 2006).

3 Migration for dream pursuing not only happens in different regions of a country, but also appears in different countries. For example, many Taiwanese are eager to pursue the "American dream" during the period of 1949 and 1987 (Berry, 2009).

Based on above viewpoint, this research proposes that the intensity of urban dream is a decreasing function of human and economic development, in other words, most of the "urban dream" comes from poverty. In addition, the intensity of urban dream is a decreasing function of rich-poor gap in the city. That is, if the rich-poor gap in the city is small, it implies that people has more chance to be successful in the city.

We can set the population growth rate of megacity is a function of human and economic development and rich-poor gap in the city, that is

$$P= P (U, Y)= P (U(D, X), Y)= P (D, X, Y)= P (D (Hed, Gap), X, Y))= P (Hed(-), Gap(-), X, Y)$$

Where

P: population growth rate of megacity;

U: utility function of individuals;

Y: other attributes which could affect population growth rate of megacity;

D: urban dream;

X: other attributes which could affect individuals' utility level;

Hed: human and economic development;

Gap: rich-poor gap in the city;

- : decreasing function.

4. The Empirical Analysis

4.1 Data Description

In order to test the proposition that the "urban dream" affects the size of megacity, and the "urban dream" is a function of human and economic development, this paper collects data of GDP, Gini Index, Rich/Poor income ratio, Human Development Index (HDI), and population dynamics of megacities all over the world.

Table 2 shows the GDP per capita in megacities in different period of time. In general, the growth rate of GDP in less developed country is higher. Table 3 shows the GDP per capita in 2018 (estimated), Gini Index, and Rich/Poor income ratio of megacities in the world.

Because GDP per capita (adjusted according to purchasing power parity, PPP) measures the income level of individuals in the country, therefore the GDP per capita is a good proxy of economic development. The reason we propose that the "urban dream" is a decreasing function of economic development level, is based on the assumption that if individual is rich enough and lasting for a long period, he will not overestimate the value of money, thus he will not migrate to metropolitan for pursuing more money. The connection between migration motive and income level reminds us that us that the Human Development Index (HDI) might be an alternative index of this idea.

The HDI is a composite statistic of life expectancy, education, and income indices used to rank countries into four tiers of human development. Namely, very high human development; high human development; medium human development; and low human development.

Tables 4 and Table 5 illustrate the index of development level of regions and megacities all over the world. Compared to Western countries, except for Japan (Tokyo) and South Korea (Seoul), most of Asian countries which owns megacity, such as China, Philippines, Indonesia, Pakistan, and Bangladesh etc., are less developed.

Table 2 The GDP per capita of Megacities in the World

Megacity (Country)	2014 GDP (growth rate)	2015 GDP (growth rate)	2016 GDP (growth rate)	2017 GDP (growth rate)	2018 GDP (growth rate)
Guangzhou (China)	13,368.17 (7.3)	14,371.95 (6.9)	15,414.65 (6.72)	16,695.60 (6.856)	18,119.97 (6.595)
Tokyo (Japan)	39,502.32 (0.375)	40,510.54 (1.354)	41,352.76 (0.961)	42,942.23 (1.735)	44,549.69 (1.137)
Jakarta (Indonesia)	10,694.45 (5.007)	11,189.60 (4.876)	11,732.32 (5.033)	12,403.74 (5.068)	13,176.46 (5.137)
Shanghai (China)	13,368.17 (7.3)	14,371.95 (6.9)	15,414.65 (6.72)	16,695.60 (6.856)	18,119.97 (6.595)
Delhi (India)	5,814.42 (7.41)	6,273.28 (8.155)	6,704.73 (7.113)	7,194.01 (6.681)	7,795.89 (7.3)
Manila (Philippines)	6,974.70 (6.145)	7,353.26 (6.067)	7,815.46 (6.876)	8,360.35 (6.685)	8,933.33 (6.517)
Seoul (Korea (South)	35,320.40 (3.341)	36,501.22 (2.79)	37,810.11 (2.929)	39,548.07 (3.063)	41,415.74 (2.762)
Bombay (India)	5,814.42 (7.41)	6,273.28 (8.155)	6,704.73 (7.113)	7,194.01 (6.681)	7,795.89 (7.3)
Mexico City (Mexico)	18,219.07 (2.804)	18,816.20 (3.288)	19,370.18 (2.898)	19,938.39 (2.041)	20,644.95 (2.193)
New York (USA)	54,952.40 (2.452)	56,718.32 (2.881)	57,814.53 (1.567)	59,792.01 (2.217)	62,517.53 (2.884)
São Paulo (Brazil)	16,360.93 (0.51)	15,817.54 (-3.549)	15,313.54 (-3.469)	15,637.12 (0.975)	16,111.56 (1.435)
Beijing (China)	13,368.17 (7.3)	14,371.95 (6.9)	15,414.65 (6.72)	16,695.60 (6.856)	18,119.97 (6.595)
Dacca (Bangladesh)	3,406.51 (6.314)	3,640.78 (6.842)	3,905.19 (7.202)	4,229.91 (7.396)	4,598.39 (7.345)
Bangkok (Thailand)	15,644.56 (0.984)	16,246.45 (3.02)	16,928.00 (3.283)	17,893.63 (3.903)	19,126.41 (4.596)
Cairo (Egypt)	11,752.77 (2.916)	12,077.39 (4.372)	12,570.61 (4.347)	12,697.64 (4.181)	13,373.56 (5.3)
Lagos (Nigeria)	6,080.34 (6.31)	6,139.54 (2.653)	5,942.87 (-1.617)	5,941.27 (0.806)	6,030.43 (1.925)
Los Angeles (USA)	54,952.40 (2.452)	56,718.32 (2.881)	57,814.53 (1.567)	59,792.01 (2.217)	62,517.53 (2.884)
Osaka (Japan)	39,502.32 (0.375)	40,510.54 (1.354)	41,352.76 (0.961)	42,942.23 (1.735)	44,549.69 (1.137)
Moscow (Russia)	27,155.82 (0.7)	26,736.45 (-2.5)	26,960.24 (-0.2)	27,892.54 (1.546)	29,032.03 (1.705)
Karachi (Pakistan)	4,772.72 (4.053)	4,922.22 (4.058)	5,103.90 (4.563)	5,377.60 (5.373)	5,714.03 (5.792)
Calcutta (India)	5,814.42 (7.41)	6,273.28 (8.155)	6,704.73 (7.113)	7,194.01 (6.681)	7,795.89 (7.3)
Buenos Aires (Argentina)	20,008.32 (-2.513)	20,551.86 (2.731)	20,178.85 (-1.823)	20,918.10 (2.854)	20,609.83 (-2.645)
Istanbul (Turkey)	22,975.43 (5.167)	24,307.42 (6.086)	25,014.30 (3.184)	27,049.04 (7.441)	28,270.23 (3.477)
Tehran (Iran)	17,470.69 (3.215)	17,157.45 (-1.586)	19,277.66 (12.518)	20,136.41 (3.732)	20,069.07 (-1.475)
London (Great Britain)	41,066.00 (2.948)	42,145.49 (2.349)	43,013.11 (1.789)	44,292.18 (1.656)	45,642.76 (1.359)
Johannesburg (South Africa)	13,244.42 (1.847)	13,349.83 (1.28)	13,359.76 (0.565)	13,572.89 (1.317)	13,774.51 (0.758)
Rio de Janeiro (Brazil)	16,360.93 (0.51)	15,817.54 (-3.549)	15,313.54 (-3.469)	15,637.12 (0.975)	16,111.56 (1.435)
Tientsin (China)	13,368.17 (7.3)	14,371.95 (6.9)	15,414.65 (6.72)	16,695.60 (6.856)	18,119.97 (6.595)
Lahore (Pakistan)	4,772.72 (4.503)	4,922.22 (4.058)	5,103.90 (4.563)	5,377.60 (5.373)	5,714.03 (5.792)
Kinshasa (Congo (Dem. Rep.))	7,237.43 (6.843)	7,323.34 (2.619)	7,018.47 (-2.829)	6,760.81 (-3.105)	6,881.45 (1.961)
Bangalore (India)	5,814.42 (7.41)	6,273.28 (8.155)	6,704.73 (7.113)	7,194.01 (6.681)	7,795.89 (7.3)
Paris (France)	40,989.66 (1.014)	41,679.81 (1.037)	42,430.00 (1.103)	44,080.66 (2.335)	45,601.10 (1.564)
Madras (India)	5,814.42 (7.41)	6,273.28 (8.155)	6,704.73 (7.113)	7,194.01 (6.681)	7,795.89 (7.3)
Nagoya (Japan)	39,502.32 (0.375)	40,510.54 (1.354)	41,352.76 (0.961)	42,942.23 (1.735)	44,549.69 (1.137)
Lima (Peru)	12,180.09 (2.406)	12,579.63 (3.307)	13,088.73 (4.035)	13,521.40 2.465)	14,252.42 (4.102)

Note: GDP are all adjusted according to purchasing power parity (PPP) rule
Source: International Monetary Fund: World Economic Outlook Database in 2018. (October 2018)

Table 3 The GDP, Gini Index, and Rich/Poor Income Ratio of Megacities in the World

Megacity (Country)	2018 GDP [a] (growth rate)	Gini Index [b]	R/P (10%) [c]	R/P (20%) [d]
Guangzhou (China)	18,119.97 (6.595)	42.2 (2012)	21.6	12.2
Tokyo (Japan)	44,549.69 (1.137)	32.1 (2008)	4.5	3.4
Jakarta (Indonesia)	13,176.46 (5.137)	39.5 (2013)	7.8	5.2
Shanghai (China)	18,119.97 (6.595)	42.2 (2012)	21.6	12.2
Delhi (India)	7,795.89 (7.3)	35.1 (2011)	8.6	5.6
Manila (Philippines)	8,933.33 (6.517)	40.1 (2015)	15.5	9.3
Seoul (Korea (South)	41,415.74 (2.762)	63.0 (2014)	7.8	4.7
Bombay (India)	7,795.89 (7.3)	35.1 (2011)	8.6	5.6
Mexico City (Mexico)	20,644.95 (2.193)	43.3 (2016)	21.6	12.8
New York (USA)	62,517.53 (2.884)	41.5 (2016)	18.5	9.4
São Paulo (Brazil)	16,111.56 (1.435)	51.3 (2015)	16	13
Beijing (China)	18,119.97 (6.595)	42.2 (2012)	21.6	12.2
Dacca (Bangladesh)	4,598.39 (7.345)	32.4 (2016)	7.5	4.9
Bangkok (Thailand)	19,126.41 (4.596)	36 (2015)	12.6	7.7
Cairo (Egypt)	13,373.56 (5.3)	31.8 (2015)	8.0	5.1
Lagos (Nigeria)	6,030.43 (1.925)	43 (2009)	17.8	9.7
Los Angeles (USA)	62,517.53 (2.884)	41.5 (2016)	18.5	9.4
Osaka (Japan)	44,549.69 (1.137)	32.1 (2008)	4.5	3.4
Moscow (Russia)	29,032.03 (1.705)	37.7 (2015)	12.7	7.6
Karachi (Pakistan)	5,714.03 (5.792)	33.5 (2015)	6.5	4.3
Calcutta (India)	7,795.89 (7.3)	35.1 (2011)	8.6	5.6
Buenos Aires (Argentina)	20,609.83 (-2.645)	42.4(2016)	31.6	17.8
Istanbul (Turkey)	28,270.23 (3.477)	41.9 (2016)	6.6	4.6
Tehran (Iran)	20,069.07 (-1.475)	38.8 (2014)	17.2	9.7
London (Great Britain)	45,642.76 (1.359)	33.2 (2015)	13.8	7.2
Johannesburg (South Africa)	13,774.51 (0.758)	63 (2014)	33.1	17.9
Rio de Janeiro (Brazil)	16,111.56 (1.435)	51.3 (2015)	16	13
Tientsin (China)	18,119.97 (6.595)	42.2 (2012)	21.6	12.2
Lahore (Pakistan)	5,714.03 (5.792)	33.5 (2015)	6.5	4.3
Kinshasa (Congo (Dem. Rep.))	6,881.45 (1.961)	48.9 (2011)	N.A.	N.A.
Bangalore (India)	7,795.89 (7.3)	35.1 (2011)	8.6	5.6
Paris (France)	45,601.10 (1.564)	32.7 (2015)	9.1	5.6
Madras (India)	7,795.89 (7.3)	35.1 (2011)	8.6	5.6
Nagoya (Japan)	44,549.69 (1.137)	32.1 (2008)	4.5	3.4
Lima (Peru)	14,252.42 (4.102)	43.8 (2016)	26.1	15.2

Note： a. **GDP** are all adjusted according to purchasing power parity (PPP) rule.
b**. Gini Index:** A quantified representation of a nation's Lorenz curve.
c. **R/P (10%):** The ratio of the average income of the richest 10% to the poorest 10%.
d. **R/P (20%):** The ratio of the average income of the richest 20% to the poorest 20%.

Source：International Monetary Fund: World Economic Outlook Database in 2018. (October 2018)
World Bank Data Catalog Gini index
Human Development Report 2009, UNDP, accessed on July 30, 2011.

Table 4 The HDI, IAHDI, IALEI, and IALI index of Regions in the World

Regions	HDI [a]	IAHDI [b] (Overall Loss)	IALEI [c] (Overall Loss)	IAII [d] (Overall Loss)
Arab Sates	0.699	0.523 (25.1%)	0.668 (15.7%)	0.564 (26.1%)
East Asia and the Pacific	0.733	0.619 (15.6%)	0.757 (10.0%)	0.572 (23.1%)
Europe and Central Asia	0.771	0.681 (11.7%)	0.732 (10.9%)	0.633 (16.7%)
Latin America and Caribbean	0.758	0.593 (21.8%)	0.753 (12.1%)	0.496 (33.2%)
South Asia	0.638	0.471 (26.1%)	0.596 (21.4%)	0.519 (17.6%)
Sub-Saharan Africa	0.537	0.372 (30.8%)	0.434 (30.8%)	0.385 (27.7%)

Note： **a. HDI**：Human Development Index, a composite index measuring average achievement in three basic dimensions of human development—a long and healthy life, knowledge and a decent standard of living.

b. IAHDI：Inequality-adjusted HDI: HDI value adjusted for inequalities in the three basic dimensions of human development.

Overall Loss：The loss in potential human development due to inequality, calculated as the percentage difference between the HDI and the IAHDI.

c. IALEI：Inequality-adjusted life expectancy index: The HDI life expectancy index adjusted for inequality in distribution of expected length of life based on data from life tables listed in Main data sources.

d. IAII：Inequality-adjusted income index: The HDI income index adjusted for inequality in income distribution based on data from household surveys listed in Main data sources.

Source： HDRO calculations based on data from UNDESA (2017a), UNESCO Institute for Statistics (2018), United Nations Statistics Division (2018b), World Bank (2018b), Barro and Lee (2016) and IMF (2018).

Calculated as the geometric mean of the values in inequality-adjusted life expectancy index, inequality-adjusted education index and inequality-adjusted income index using the methodology in Technical note 2 (Available at http://hdr.undp.org/sites/default/files/hdr2018_technical_notes.pdf).

Table 5 The HDI, IAHDI, IALEI, and IALI index of Megacities in the World

Megacity	Country	HDI [a] (Rank)	IAHDI [b] (Overall Loss)	IALEI [c] (Overall Loss)	IAII [d] (Overall Loss)
Guangzhou	China	0.752 (86)	0.643 (14.5%)	0.799 (7.9%)	0.582 (23.3%)
Tokyo	Japan	0.909 (19)	0.876 (3.6%)	0.955 (2.9%)	0.844 (6.3%)
Jakarta	Indonesia	0.694 (116)	0.563 (18.8%)	0.647 (14.8%)	0.532 (24.9%)
Shanghai	China	0.752 (86)	0.643 (14.5%)	0.799 (7.9%)	0.582 (23.3%)
Delhi	India	0.640 (130)	0.468 (26.8%)	0.590 (21.4%)	0.509 (18.8%)
Manila	Philippines	0.699 (113)	0.574(17.9%)	0.648 (14.4%)	0.500 (26.8%)
Seoul	Korea (South)	0.903 (22)	0.773 (14.3%)	0.929 (3.2%)	0.709 (20.2%)
Bombay	India	0.640 (130)	0.468 (26.8%)	0.590 (21.4%)	0.509 (18.8%)
Mexico City	Mexico	0.774 (74)	0.609 (21.3%)	0.773 (12.3%)	0.521 (32.8%)
New York	USA	0.924 (13)	0.797 (13.8%)	0.865 (5.6%)	0.685 (28.1%)
São Paulo	Brazil	0.759 (79)	0.578 (23.9%)	0.765 (10.8%)	0.471 (36.7%)
Beijing	China	0.752 (86)	0.643 (14.5%)	0.799 (7.9%)	0.582 (23.3%)
Dacca	Bangladesh	0.608 (136)	0.462 (24.1%)	0.672 (17.3%)	0.459 (15.7%)
Bangkok	Thailand	0.755 (83)	0.636 (15.7%)	0.774 (9.3%)	0.581 (23.8%)
Cairo	Egypt	0.696 (115)	0.493 (29.2%)	0.703 (11.6%)	0.446 (36.3%)
Lagos	Nigeria	0.532 (157)	0.374 (34.7%)	0.326 (37.4%)	0.429 (28.2%)
Los Angeles	USA	0.924 (13)	0.797 (13.8%)	0.865 (5.6%)	0.685 (28.1%)
Osaka	Japan	0.909 (19)	0.876 (3.6%)	0.955 (2.9%)	0.844 (6.3%)
Moscow	Russia	0.816 (49)	0.738 (9.5%)	0.725 (8.0%)	0.683 (17.7%)
Karachi	Pakistan	0.562 (150)	0.387 (31.0%)	0.495 (31.0%)	0.531 (11.6%)
Calcutta	India	0.640 (130)	0.468 (26.8%)	0.590 (21.4%)	0.509 (18.8%)
Buenos Aires	Argentina	0.825 (47)	0.707 (14.3%)	0.790 (9.5%)	0.585 (25.8%)
Istanbul	Turkey	0.791 (64)	0.669 (15.4%)	0.779 (9.6%)	0.644 (22.6%)
Tehran	Iran	0.798 (60)	0.707 (11.4%)	0.786 (9.0%)	0.637 (19.7%)
London	Great Britain	0.922 (14)	0.835 (9.4%)	0.912 (4.0%)	0.726 (19.5%)
Johannesburg	South Africa	0.699 (113)	0.467 (33.2%)	0.532 (20.3%)	0.315 (56.4%)
Rio de Janeiro	Brazil	0.759 (79)	0.578 (23.9%)	0.765 (10.8%)	0.471 (36.7%)
Tientsin	China	0.752 (86)	0.643 (14.5%)	0.799 (7.9%)	0.582 (23.3%)
Lahore	Pakistan	0.562 (150)	0.387 (31.0%)	0.495 (31.0%)	0.531 (11.6%)
Kinshasa	Congo (Dem. Rep.)	0.457 (176)	0.319 (30.3%)	0.394 (36.1%)	0.225 (28.2%)
Bangalore	India	0.640 (130)	0.468 (26.8%)	0.590 (21.4%)	0.509 (18.8%)
Paris	France	0.901 (24)	0.808 (10.3%)	0.930 (3.6%)	0.739 (18.1%)
Madras	India	0.640 (130)	0.468 (26.8%)	0.590 (21.4%)	0.509 (18.8%)
Nagoya	Japan	0.909 (19)	0.876 (3.6%)	0.955 (2.9%)	0.844 (6.3%)
Lima	Peru	0.750 (89)	0.606 (19.2%)	0.737 (13.2%)	0.517 (28.3%)

Source：

HDRO calculations based on data from UNDESA (2017a), UNESCO Institute for Statistics (2018), United Nations Statistics Division (2018b), World Bank (2018b), Barro and Lee (2016) and IMF (2018).

Calculated as the geometric mean of the values in inequality-adjusted life expectancy index, inequality-adjusted education index and inequality-adjusted income index using the methodology in Technical note 2 (available at http://hdr.undp.org/sites/default/files/hdr2018_technical_notes.pdf).

4.3 Empirical Results

In order to study the relationship among human development, economic development, and the population dynamics of megacities, we set up an OLS regression model 1.

$$P = \alpha + \beta \cdot GDP + \gamma \cdot R/P(10\%) + \varepsilon \quad \text{(model 1)}$$

Where

P: annual growth rate of population of megacity;

GDP: gross domestic product, a proxy of economic development;

R/P(10%): the ratio of the average income of the richest 10% to the poorest 10% income level, a proxy of megacity environment;

α, β, γ *:* coefficients of OLS regression.;

ε : error term.

In model 1, the GDP per capita is a proxy of economic development; the R/P (10%), that is, the ratio of the average income of the richest 10% to the poorest 10%, is a measure of megacity environment.

We propose that the "urban dream" is a decreasing function of economic development level, in other words, the "urban dream" is a decreasing function of GDP per capita; in addition, the "urban dream" is a decreasing function of Rich/Poor ratio.

Since there are some alternative indexes which could be used to be the proxy of human development and economic development, the proxy of megacity environment, model (2), (3), (4), and (5) are alternative regression models.

$$P = \alpha + \beta \cdot GDP + \gamma \cdot R/P(20\%) + \varepsilon \quad \text{(model 2)}$$

$$P = \alpha + \beta \cdot HDI + \gamma \cdot R/P(20\%) + \varepsilon \quad \text{(model 3)}$$

$$P = \alpha + \beta \cdot IAHDI + \gamma \cdot R/P(10\%) + \varepsilon \quad \text{(model 4)}$$

$$P = \alpha + \beta \cdot IAHDI + \gamma \cdot R/P(20\%) + \varepsilon \quad \text{(model 5)}$$

Where

HDI: human development index;

IAHDI: inequality-adjusted human development index;

R/P(20%): the ratio of the average income of the richest 20% to the poorest 20% income level.

Table 6 shows the results of OLS regression from model 1 to model 5. These are no autocorrelation and multi-collinearity problems in all models.

First, the regression coefficients of GDP in model 1 and model 2, the coefficient of HDI in model 3, and the coefficients of IAHDI in model 4 and model 5 are all significantly negative. According to the idea of adjusted pull-and-push model with "urban dream" factor, it implies that the human and economic development has negative effect on the intensity of urban dream, therefore the lower the human and economic development will induce more people migrate into megacities.

Second, the coefficients of income inequality indexes R/P(10%) and R/P(20%) are all not significant, it means that the wealth distribution of megacity does not influence the population growth of megacity.

Table 6 The Results of OLS Regression Models

Variable	Model 1	Model 2	Model 3	Model 4	Model 5
Constant	0.031*** (0.004)	0.034*** (0.004)	0.078*** (0.009)	0.055*** (0.007)	0.056*** (0.007)
GDP	-5.365E-7*** (0.000)	-5.468E-7*** (0.000)			
HDI			-0.079*** (0.012)		
IAHDI				-0.057*** (0.009)	-0.057*** (0.009)
R/P(10%)	0.000 (0.000)			-6.418E-5 (0.000)	
R/P(20)%		0.000 (0.000)	-7.157E-5 (0.007)		0.000 (0.000)
Adjusted-R^2	0.507	0.526	0.578	0.513	0.520
F value	17.978***	19.274***	23.591***	18.351***	18.874***
D-W value	1.931	1.963	1.871	1.778	1.823
Number	34	34	34	34	34

Note: 1.Dependent variable: Annual growth rate of population of megacities,

2. Number in parenthesis is the standard error of regression coefficient.

3. ***, **, and * denote significant at 1%, 5%; and 10% levels, respectively.

5. Concluding Remarks

Urbanization might be an irreversible process in the civilized world.

In general, we use push-and-pull theory to illustrate the city population dynamics, that is, on the one hand, the economies of scale, economies of agglomeration, positive locational externalities, and the pressure of rural poverty, are thought to be the positive drivers for promoting city population growth; on the other hand, each kind of cost accompanying with increasing population constrain the expansion of city population.

However, there are some interesting differences between Eastern and Western megacities. First, Among the 35 megacities in the world, 20 of them, including the top eight, are located in Asia; second, the population density of city in the East is usually denser than that in the Western cities, of the 20 urban areas with the highest population density in the world, eight are located in mainland China (Tan et al., 2008), and last, the population in Asian megacities still increases constantly with rapid economic development.

In order to explain the differences of Eastern and Western megacities, this paper adds the "dream pursuing" factor into the residents' utility function, that is, the choice of individual's migration not only depends on some economic reasons, but also on the consideration of "dream pursuing" factor. The adjusted push-and-pull theory with urban dream could be mirrored on the giant city population size, the dense population density, and the higher population growth rate in Asian megacities.

In order to seek empirical supports of the "urban dream" effects, this research proposes that the intensity of "urban dream" is a decreasing function of human and economic development, because of most of the "urban dream" comes from poverty; In addition, the intensity of urban dream is a decreasing function of rich-poor gap in the city, that is, little rich-poor gap in the city let people think they have better chance to be successful in the metropolitan.

According to the empirical results of 35 megacities all over the world in 2018, the human and economic development level does have negative effect on the population growth rate of megacity. In other words, in the frame of adjusted push-and-pull theory with urban dream factor, the empirical results imply that the higher human and economic development level will decrease the intensity of urban dream, thus the population growth rate is lower in highly-developed megacities.

Besides, we use the income inequality index to be the proxy of megacity environment, the empirical results finds that the income inequality indexes, Gini index, R/P(10%) and R/P(20%), do not have significant effect on the population growth rate of megacity

Based on the push-and-pull theory, the idea of "urban dream" in this research provides a cultural explanation for the differences between Western and Eastern megacities.

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