Research on Relationship Between Urban Expansion and Migration of Shanghai

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- Introduction
- Literature Review
- Case study of Shanghai
- Relationship analysis
- Conclusion
- Discussion and suggestions
- References
Massive urbanization, accompanied by the rapid expansion of cities and metropolitan regions and the sprawling growth of megacities all over the world, is one of the most important transformations of our planet. (Lincoln Institute of Land Policy)
Table 1  World urbanization trends

<table>
<thead>
<tr>
<th></th>
<th>world</th>
<th>Developed countries</th>
<th>Developing countries</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Urban Populati</td>
<td>Urbanization (%)</td>
<td>Urban Population (%)</td>
</tr>
<tr>
<td>1950</td>
<td>7.34</td>
<td>29.2</td>
<td>4.47</td>
</tr>
<tr>
<td>1960</td>
<td>10.32</td>
<td>34.2</td>
<td>5.71</td>
</tr>
<tr>
<td>1970</td>
<td>13.71</td>
<td>37.1</td>
<td>6.98</td>
</tr>
<tr>
<td>1980</td>
<td>17.01</td>
<td>39.6</td>
<td>7.98</td>
</tr>
<tr>
<td>1990</td>
<td>22.34</td>
<td>42.6</td>
<td>8.77</td>
</tr>
<tr>
<td>2000</td>
<td>28.54</td>
<td>46.6</td>
<td>9.5</td>
</tr>
<tr>
<td>2010</td>
<td>36.23</td>
<td>51.8</td>
<td>10.11</td>
</tr>
</tbody>
</table>

By the year 2005, urban areas have been home to more than half of the world’s population.

With stable development of urbanization, more and more people move to cities and towns in search of employment, educational opportunities and higher standards of living.

Migration has formulate the dominant reason for population increase.

Source: http://www.mofangge.com/html/qDetail/06/g1/201012/y5p5g10679302.html
General objective

The main purpose of this research is to find out the inside relationship between population migration and urban expansion.

Special objectives

- Trace the historical evolution of the urban expansion process and also changes of floating population
- Build basic models to identify if there is any relationship between migration and urban expansion
- Find out the rational size for urban expansion in Shanghai and propose urban policies to manage population migration.
Hypothesis

Population migration and urban expansion are in close contact with each other, they have positive interrelations.

Also they are interact and interrelated, population migration can promote urban expansion and expansion can direct the flows of population migration.
Urban Expansion

- Changes and promotes of land use and land cover
- Urban expansion form and growth models
- Influences of urban expansion on natural resources, environment and global change ...
- Urban development prediction models

Population Migration

- Migration models
- Mechanisms
- Influencing factors
- Empirical studies of different dimensions

--- Migration and urbanization (Kevin Honglin ZHANG, Shunfeng SONG, 2003)

--- Migration and socio-economic development (George J. Borjas, 1989; WANG G-X etc., 2006)

--- Migration and urban forms (Naroll and Bertalanffy, 1956; Small, 1996; Damuth, 2001; Yang Yanyun, 2004; He and Zhang, 2006; Zhong Wen, 2010)

--- Others (Michael, 1969; Kristin, Anne, 1998; Zhou Hongshu etc., 2008; Stephen, Matthew, etc., 2010)
Shanghai

Between the range of 120°51′E - 122°12′E, 30°40′N - 31°53′N; sits at the mouth of the Yangtze River in the middle portion of the Chinese coast. borders Jiangsu and Zhejiang to the north, south and west, and is bounded to the east by the East China Sea.

Size: 6340 km²
Population: 22.65 million
Density: 6200 population/km²
In-migration: 1.72 million
Out-migration: 0.5 million

Case study
Table 3  the size of the built-up area of Shanghai in different periods(/km²)

<table>
<thead>
<tr>
<th>Years</th>
<th>Size of the images(units)</th>
<th>Size of built-up area</th>
<th>Extended size</th>
<th>Annual extended size</th>
</tr>
</thead>
<tbody>
<tr>
<td>1930s</td>
<td>601504</td>
<td>60.15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1950s</td>
<td>1013264</td>
<td>101.33</td>
<td>40.18</td>
<td>2.01</td>
</tr>
<tr>
<td>1970s</td>
<td>1805220</td>
<td>180.52</td>
<td>79.19</td>
<td>3.96</td>
</tr>
<tr>
<td>1988</td>
<td>2708455</td>
<td>270.85</td>
<td>90.33</td>
<td>5.02</td>
</tr>
<tr>
<td>1993</td>
<td>3802776</td>
<td>380.28</td>
<td>109.43</td>
<td>21.89</td>
</tr>
<tr>
<td>1998</td>
<td>5692399</td>
<td>569.24</td>
<td>188.96</td>
<td>37.79</td>
</tr>
</tbody>
</table>

Note: this table comes from Wan C-R, Xu X-L’s APPLICATION OF REMOTE SENSING DATA FUSION FOR THE RESEARCH OF URBAN DEVELOPMENT.

Table 4  the size of built-up area of different years of Shanghai(/km²)

<table>
<thead>
<tr>
<th>Year</th>
<th>Size of built-up area</th>
<th>Extended size</th>
<th>Annual extended size</th>
</tr>
</thead>
<tbody>
<tr>
<td>1990</td>
<td>249.8</td>
<td>140.4</td>
<td>28.08</td>
</tr>
<tr>
<td>1994</td>
<td>390.2</td>
<td>159.38</td>
<td>31.876</td>
</tr>
<tr>
<td>1999</td>
<td>549.58</td>
<td>270.3</td>
<td>54.06</td>
</tr>
<tr>
<td>2005</td>
<td>819.88</td>
<td>178.92</td>
<td>35.784</td>
</tr>
<tr>
<td>2010</td>
<td>998.8</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: the data about the size of the built-up area comes from China Statistical Yearbook of different years, but based on different statistical standards, China's National Bureau of Statistics started to collect built-up area data after 1990, as a result, before 1990 we cannot find any numbers.
Shanghai witnessed continuously increased extended urban land.

**Before 1970s**
- The urban built-up areas of Shanghai have formed its basic structure.
- It’s a period with low-speed development, and the built-up area was not very big.

**From 1970 to 1988**
- It is the period for the preparation and prophase of Chinese reform and open-up policy.
- The extension was defined only in the Concession, it’s still not a booming stage.

**From 1989 to 2005**
- It is the rapid expansion period, with twice of the size increase and 10 times of the annual extension.
- governments and administrations tried to change administrative districts, constructed satellite towns

**From 2005 to now**
- governments to pay more attention on the social economic and environmental problems for compact and sustainable development.
- The development of underground is one way for controlling the overexploitation.
After 1978 there were more in-migrants than out-migrants, while before the situation was opposite.

Generally, the migration has the same tendency as population growth—fluctuated at the first twenty years and then stabilized gradually.
Evolution of population migration of Shanghai

- **1950 - 1957**: The first five-year plan
  - Large scale of migration
  - Out-migration > in-migration

- **1958 - 1977**: Hukou system (household registration)
  - Cultural Revolution
  - Lower level of migratory activity
  - A dominance of outmigration

- **1978 - 1993**: Reform and open-up policy
  - Large wave of return migration
  - An incomplete development era and fluctuation period

- **1994 - 2003**: A continuous and steady growth stage
  - Positive and increased net migration

- **2004 -**
  - The senior stage of migration
  - A phase has the priority to move in
  - The smallest out-migration
Above all, the urban expansion and population migration shared the synchronous development in Shanghai’s history. Here I will use the **regression model** and **allometric growth model** to analyze their relationship as well as the growth speed between them.

If they are in some sense responsible with each other, we would expect to see a change in the number of net migration associated with a change in the size of the built-up area.
There is a good deal of variation in both two of the factors and there is a positive correlation between them. In general, from 1950 to 2010 the migration stock changed with the increase of the built-up area.

\[
y = 0.281x - 40.095
\]

\[
y = 0.2828x - 10.209
\]

The slope rates are 0.281 and 0.2828 which present a positive interrelation.
Allometric Model is a biological concept which implies the increase in size of different organs or parts of an organism at various relative rates of growth. Then, it was employed to describe the relationship between a system of cities and the largest city within the urban system.

\[
\frac{1}{y} \frac{dy}{dt} = b \frac{1}{x} \frac{dx}{dt} \quad \Rightarrow \quad y = ax^b
\]

Among them,
y is some kind of prediction of part or subsystem;
x is some kind of prediction of the whole system;
b is scaling factor, can also be called as allometric growth coefficient.

When \( b > 1 \), positive allometric development, which shows that the growth of urban land is faster than that of the population, population density decreased;
when \( b < 1 \), negative allometric development, which means lower growth of urban land than population, and population density increased;
when \( b = 0 \), which indicates that there is no relationship between urban land and population, and the population density doesn’t change;
when \( b = 1 \), which illustrates same speed growth, two of the factors present linear growth.
The graph presents the allometric growth of Shanghai’s urban expansion and net migration since 1990, $R^2$ reaches to 0.7017.

Here $b$ equals to 1.5287 ($b>1$), which means positive allometric development and lower growth of net migration speed than urban expansion, the population density will decrease in the future gradually. However, with the limitation of the urban land extension and change of the migration policy, this situation can get better.
The creation of the migration to urban expansion

Urban expansion is usually considered as one of the most obvious spatial characteristics of urban development. Actually, urban expansion can be explained by several indicators: the size of the built-up area, the urban intensity index, the social economic extension, urbanization and others.
Migrants are dominant sources to Shanghai’s urbanization growth.

\[ \text{urbanization} = \frac{\text{urban population}}{\text{total population}} \]

Total population witnessed relatively lower growth than urban population especially after 1978.

Average increase rate of the total population is 1.58% while that is 1.56% of urban population.
Migration dominates the urban growth during 1950 to 2010.

The average share of the net migration reaches to 52.42%.

Migration is positive to urban expansion of urbanization.
Migration affects socio-economic center of gravity.

The calculation of economic gravity follows the principles of decomposition and synthesis of the gravity, the method is mainly used to identify the spatial location of regional gravity as well as the movement and direction of the gravity of different years.

\[
\bar{X}_j = \frac{\sum_{i=1}^{17}(M_{ij} \times x_i)}{\sum_{i=1}^{17} M_{ij}} \quad \bar{Y}_j = \frac{\sum_{i=1}^{17}(M_{ij} \times y_i)}{\sum_{i=1}^{17} M_{ij}}
\]

There are n subareas in a certain region, here Shanghai has 17 county-level divisions; Mij is the economic indicators of area i in the year j; (xi, yi) are the geographical coordinates; the coordinates of the gravity of the region are \(( \bar{X}, \bar{Y} )\).
Figure shows the change of the gravity of migration of each district or county during 1985 to 2010.

Even though all the gravities mainly gathered in the city center, there are lots of differences among in-migration, out-migration and net migration.

The industrial output gravities have more or less the same tendency as migration.
Interference of Pudong new district

From 1985 to 2010, the in-migration and out-migration principally gathered at Putuo district and the net migration at Changning district, accompany with the migration the industrial gravity moved at Putuo and Changning district at the same period.

Even though the industrial gravity has a outward tendency from the city center while the migration fluctuated at the urban edge, they still occupied almost the same area.
The direction of the urban expansion to migration

It is the urban renewal, spatial expansion and rapid development of urbanization that make the spatial distribution and flows of migration unbalance. (Wang Guixin, Shen Xulei. 2008)
Relationship analysis
What’s more, the number and size of population migration are also determined by types of land use.
In 1982 commercial and industrial areas are main driver for both in-migration and out-migration.

Districts with large size of commercial and industrial land have high number of migrants.

Yangpu, Hongkou, Zhabei and Huangpu
However, with time goes, location and circumstance of residential land, instead of commercial land have become the key factors.

City centre with high land price and and poor environment lost migrants gradually, migrants gather at the urban edge without industries.

Yangpu, Xuhui and Changning
There is a great deal of variation in both urban expansion and migration, and they are positively correlated with each other.

At the same time, they are interrelated and interact with each other: population migration can help to create urban expansion, and the urban expansion in turn direct the population migration.
Evidence from the statistic yearbooks of Shanghai shows that Shanghai has experienced tortuous processes of urban expansion since 1949.

Generally, we can say that Shanghai is a in-migrated city, because there are more in-migrants than out-migrants throughout history data.

From 1950 to 2010 the migration stock changed with the increase of the built-up area, and they are positive connected with each other. And they follow the allometric growth model with lower growth of net migration speed than urban expansion.

Population is the active factor for urban expansion, migration can recreate urban spaces and urban development in some sense. First of all, migrants are dominant sources to Shanghai’s urbanization growth. Secondly, migration affects socio-economic center of gravity.

Urban expansion can direct the development of migration, areas with different expansion speed and regularities can lead to different distribution and flows of migration.
Since lower migration increase speed than urban expansion, some policies should be published for control the scale of construction land, use each inch of land rationally and try to mine development potential in the stock land to slow the speed of the city outward expansion.

At the same time, give some financial subsidies for rebuilding on the brownfield and high-rise buildings, improve the urban functions and realize urban renewal, reduce the outer land of the urban groups.

Governments can make some relative population policies to make sure enough work staffs for city development as well as quality of people's lives.

A detailed strategic planning for Shanghai can be made based on the general urban planning and land use planning to identify the scale of land extension and population growth as well as the direction and size of migration.
Thank you!