Formation of Megacities in the Era of Population Ageing
Mobility Comparison between China, Japan and South Korea

Hayashi, Reiko
National Institute of Population and Social Security Research
2-2-3 Uchisaiwaicyo, Chiyoda-ku, Tokyo 100-0011
Tel: +81-(0)3-3595-2984 Email: hayashi-reiko@ipss.go.jp

Abstract

The migration is one of the important components which differentiate the population distribution. In case of Japan and South Korea, the concentration of population in the regions surrounding Tokyo and Seoul has been notable especially since 1960's, but the same concentration is not observed in China. It might be due to a difference in the way people move between these three countries.

Using 2010 census data of three countries and National Survey on Migration of Japan in 2011, 9 indicators on internal migration were identified to compare the level of mobility. The calculated mobility indices of China and South Korea were 0.475 and 2.196 respectively, against the base index of Japan of 1.000. Chinese mobility is half of Japanese and South Korean mobility is double the Japanese.

As for the floating population in China, the 2010 census recorded 261 million or 20.8% of total population, but compared to the equivalent rate of Japanese and South Korean lifetime mobility, the proportion of floating population of China is much smaller. The extreme high South Korean mobility is found in every age-group and intra-municipality migration or "neighbourhood move" occupies large portion of it. It can be anticipated that the mobility of South Korea was even higher back in the 1990's.

The concentration of population in the regions surrounding Seoul and Tokyo can be the result of high mobility while the absence of such concentration in China might be due to the comparatively low and restricted mobility.

Keywords: East Asia, Population distribution, Internal migration, Mobility

Introduction

In the last century when the total population was growing rapidly in the world, the concentration of population in megacities was considered nothing special. However now in the new era of slow population growth or even the decline,

monotonic population increase of megacities is not automatically guaranteed and the competition between cities, regions and countries would be more and more intense. This is particularly true in East Asian countries where the extremely low birth rate prevails. In line with policies to stimulate and promote the child bearing and rearing, how to attract the in-migrants and better orient the internal migration has become a new policy challenge.

In Japan, the strong internal migration occurred in 1960's and since 1970's the number and rate of migration keeps on declining. People move less but preferably to the large metropolitan area, such as Tokyo, Osaka or Nagoya and as a result, the concentration of population proceeds in those regions (Figure 1).

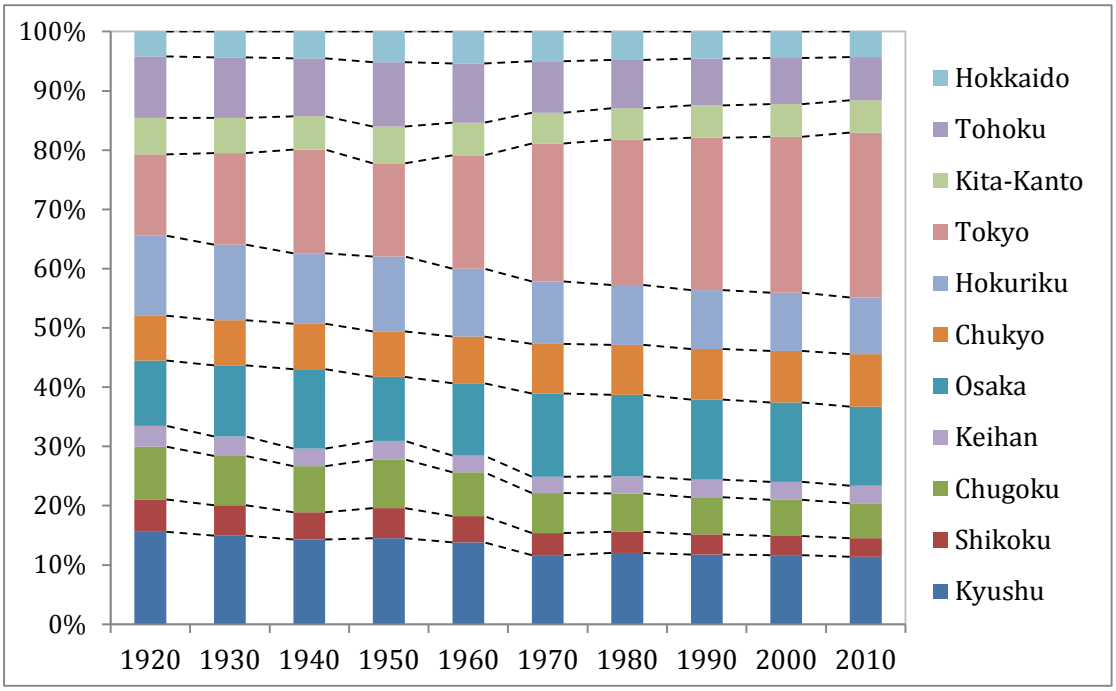

Figure 1 Proportion of population by regions of Japan, 1920-2010
Note : Chukyo includes Nagoya city.
Source : Population Census of Japan, Statistics Japan

As for South Korea, the situation is similar to Japan. The migration rate hit the highest in 1990 then it has been decreasing (Choi 2004). In consequence, the population concentration in and round Seoul is notable (Figure 2).

In the People's Republic of China (hereinafter referred to as "China"), the internal migration, especially out of registration or "floating population", is a key issue of policy debate recently and the volume of floating population is increasing since 1990's (Chan 2013). However, the regional population distribution seems not as much affected as in Japan or South Korea (Figure 3).

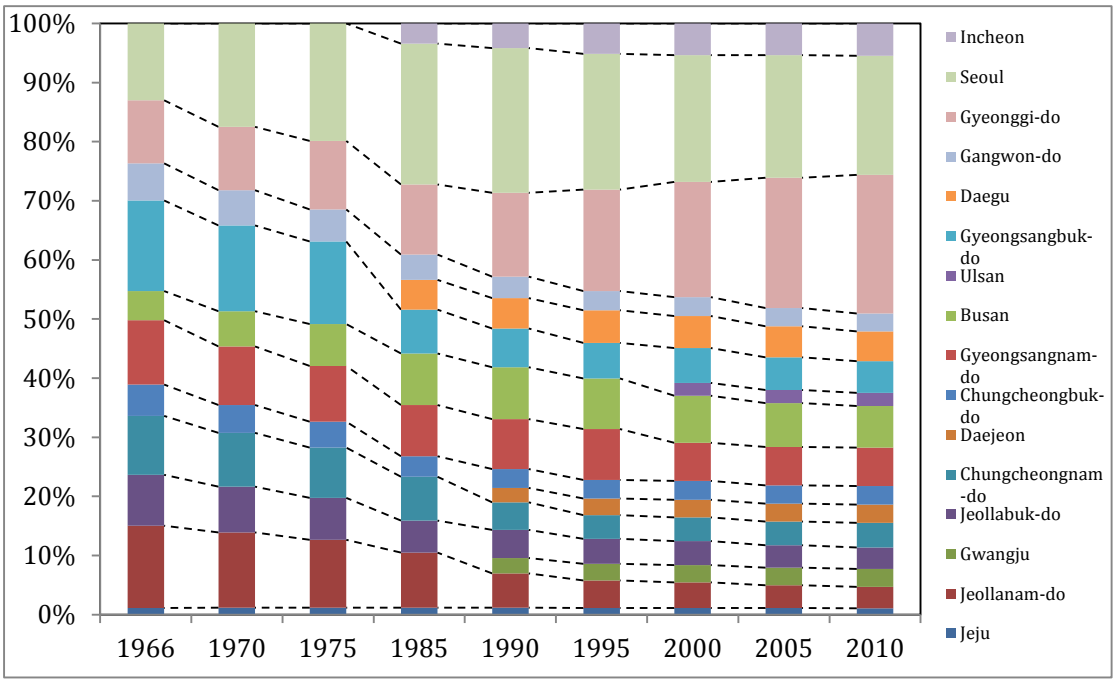

Figure 2 Proportion of population by Provinces of South Korea, 1966-2010

Source : Population and Housing Census of South Korea, Korea National Statistical Office

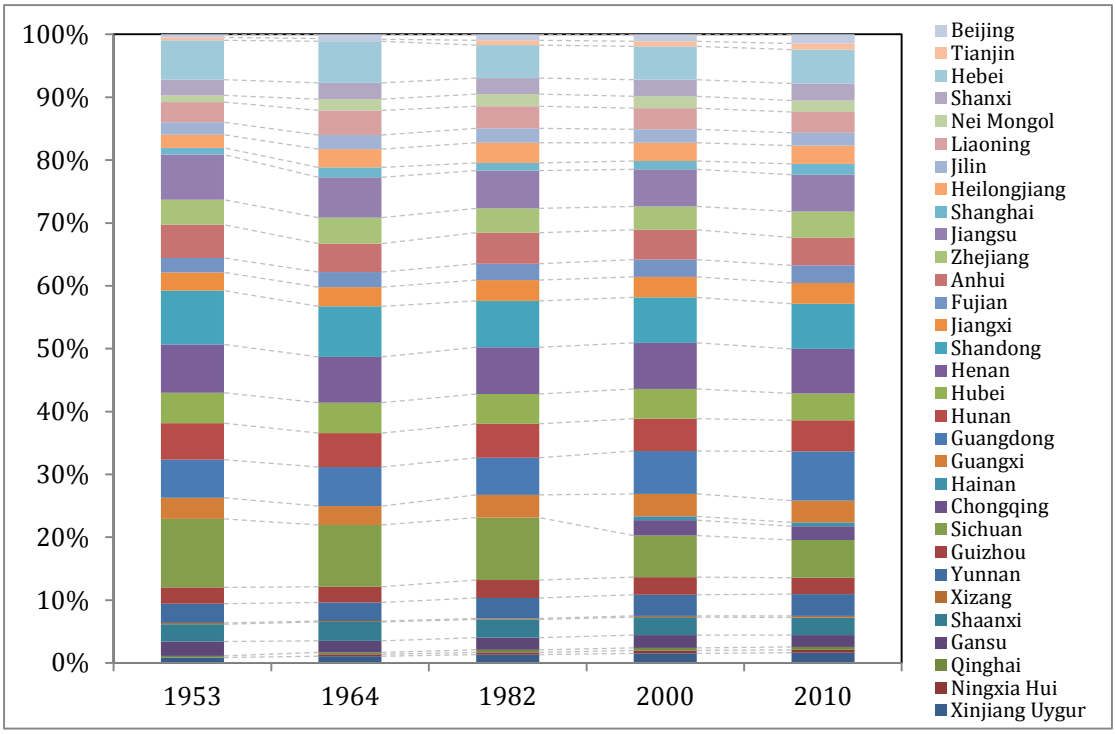

Figure 3 Proportion of population by Provinces of China, 1953-2010

Source : Population Census of the People's Republic of China, National Bureau of Statistics of the People's Republic of China

To study the flow of people movement, it is important to observe data. Most countries include the questions on internal migration in the national periodic census

and additional information using administrative record or sample surveys are available in some countries. Extensive analyses have been conducted on the level of individual country, regarding the population movement and subsequent change of the regional population distribution, but when it comes to international comparison, the studies were limited due to the fact that the unified or comparable indicators are difficult to obtain between different countries.

This paper aims to examine existing data on internal migration of three East Asian countries, China, Japan and South Korea, to compare the level of internal migration or mobility, in order to clarify the mechanism of urbanization and population distribution of each country.

Data

There are several sources on the internal migration data of the three countries concerned. In case of Japan, there are basically 3 data sources, namely Population Census, Report on Internal Migration derived from the Basic Resident Registers and the National Survey on Migration (NSM-J) conducted by National Institute of Population and Social Security Research (Japan). Almost all types of mobility indicators are available due to the availability of microdata of NSM-J to the author.

In 2010 Census of Japan, the questions on “duration of stay at present residence” and “place of residence 5 years ago” were asked. There are the standard census questions recommended by the United Nations.

In Japan, every Japanese person are registered in two ways, one in household register (戸籍) , and the other the Basic Resident Registers. The two registers have different history of implementation, but presently linked to each other to some extent and kept, updated and managed by the municipality(市区町村) offices. When a person moves from one place to another, it is obligatory to declare the municipality office of the new place of residence, so that the Basic Resident Registers of sending and receiving municipalities are updated. There is no restriction on moving in Japan. The Report on Internal Migration is the compiled statistics of these administrative records on the change of address, published yearly by the Ministry of Internal Affairs and Communications. Thus, the data is on the number of moves in Japan for the period of 1 year. If a person moves twice in one year, then it will be counted twice in the statistics. So far the statistics is only available on the inter-prefectural and inter-municipal moves, not on international move (which used to be available for the period of 1999-2004) or intra-municipal move.

NSM-J is a quinquennial survey and produces governmental statistics on migration in Japan. The latest survey in 2011 includes the questions on;

- the duration of stay at the present residence and location of previous residence and reason of move
- the location of residence at birth, junior high-school graduation, last school graduation, first employment, just before and after the first marriage, 5 years ago, 1 year ago
- the prefectures and foreign countries ever lived more than 3 months
- probable place of residence 5 years ahead and the reason of move
- place of residence of parents and children

As the NSM-J of 2011 was basically carried out in July 2011, 4 months after the Great East-Japan Earthquake, the affected prefectures (Fukushima, Miyagi and Iwate) were not surveyed. This, as well as the possible influence on mobility at national level, might be causing some deviation but here the data is used in the assumption that the effect of the earthquake is minor and the data can be similar to that of Census mobility data of 2010.

As for South Korea, there are also 3 sets of data namely Population and Housing Census, Annual Report on Internal Migration Statistics from civil registration and sample surveys conducted by Korea National Statistics Office in 1966, 1983 and 1997(Choi 2004), but so far the Population Census is the only available data source to the author.

In the South Korean Census of 2010, there are 3 questions asking on the internal migration; place of birth, place of residence 1 year ago and 5 years ago. These questions were also asked in the Census of 2000 but the result data of 2000 includes only the number who moved across the municipality (시군구) boundary so attention must be paid for longitudinal comparison.

In China, as the migration has been officially controlled by Hukou (户口 or household register) system, the data on migration can be obtained both by Population Census and administrative data of the change of household register. There are not a few the sample surveys of migration which the author does not have detailed information for now.

In the Chinese Census of 2010, there were standard questions on migration such as place of birth and place of residence 5 years ago, as well as questions on the household register (the location of register, the duration since the person moved from the place of register, the reason of move and the types of register).

The available data on internal migration for three countries are collected from Census of 2010 and NSM-J of 2011, and 9 indicators are identified which are available at least two of the countries, as listed in Table 2. They are classified as lifetime, 5 year and 1 year mobility time-wise. Geographically, they are classified as the simple move (if one moved or not, regardless of the distance) and the move which

cross the major or minor administrative division. As it is recommended by the United Nations that the place of residence is asked at "the major or smaller civil division" (UN 2008), it is customary that the census asks questions on internal migration using at least two levels of administrative division. Though for the international comparison, it is important to take into account the difference of the system of administrative division of each country. This point will be later discussed.

The Chinese census data on household register is not included in the list, as the nature and definition is different but the comparison will be tried in the Discussion section.

Description of each indicator

The same residence at birth is the rate defined as the number of persons who are now living in the same house as she/he was born, divided by the total population of the country. The nominator includes those who moved out and came back to the native house, or return migrants. In Japan, traditionally, the mother tends to be back to their native family to give birth, but the question asks not exact place of birth (in that case most of the births happen in hospitals in Japan though) but the usual residence of the mother around the time of the birth. This rate is available in Japan and South Korea, 22.1% and 7.8% respectively, South Korea having much smaller value.

Birth in the same minor administrative division is the rate defined as the number of persons who are now living in the same minor administrative division as she/he was born, divided by the total population of the country. *Birth in the same major administrative division* is the same but the geographical boundary is larger. As in "the same residence at birth" indicator, those who move out and came back are also included in the numerator.

5 year mobility is the rate defined as the number of persons whose usual residence 5 years ago is different than now, divided by the total population of the country. All the moves of whatever geographical range is included in the nominator of this indicator. Even if the person moved to another location in the same municipality, it is counted. Those who lived in the same residence 5 years ago, moved out and came back are also included in the nominator. In the case of Japan, the returnee proportion was calculated using census 2010, and the proportion was sufficiently small (1.4%) (Hayashi 2014).

5 year mobility of major administrative division is the rate defined as the number of persons whose usual residence 5 years ago was in different major administrative division or abroad. The major administrative division is set by each national statistical office as Province (省) for China, Prefecture (県) for Japan and Province (시도) for South Korea.

5 year immobility of minor administrative division is defined as the rate of persons whose usual residence 5 years ago remained within the same minor administrative division. The numerator includes also those who did not move. The minor administrative division is set by each national statistical office as County (县) for China, Municipality (市区町村) for Japan and Municipality (시군구) for South Korea.

1 year indicators are the same as the set of 5 year indicators except that the reference time point is 1 year ago.

Administrative division of three countries

The population size of China is 10 times that of Japan and one province of China can be equivalent of Japan or South Korea. While the mobility indicators use the geographical range such as major or minor administrative division, comparing these rates between countries needs a basic understanding of these administrative divisions. In China, there are basically 4 levels of administrative divisions namely Province, Prefecture, Country and Township whereas there are 2 levels in Japan (Prefecture and Municipality) and 3 levels in South Korea (Province, Municipality and Sub-municipality) [1] as shown in Table 1.

In respective census of 2010, major administrative division is set as Province (China), Prefecture (Japan), Province (South Korea) and minor administrative division is set as County (China), Municipality in Japan and South Korea. However, the corresponding division is not so equivalent. For example, the median population of Province of China is 37 million, much bigger than that of Prefecture of Japan (1.7 million) or Province of South Korea (1.9 million). The Japanese Prefecture and South Korean Province are more similar to the Prefecture level of China, with the median population of 3.2 million. As for the minor administrative division, County level of China and Municipality level of South Korea are similar but Municipality level of Japan is close to Township level of China or Sub-municipality level of South Korea. The population size distribution of each administrative division of each country is also consistent to this observation (Figure 4).

The size distribution of Chinese Prefecture, Japanese Prefecture and South Korean Province is similar. Chinese County and South Korean Municipality have similar distribution whereas Japanese Municipality is close to Chinese (of Jiangsu Province) Township and Sub-municipal level of South Korea. The indicators of mobility should be compared taking into these aspects.

[1] More community levels exist in all three countries, though.

Table 1 Name and basic characteristics of different level of administrative division of China, Japan and South Korea

(**Bold** names refer to major or minor administrative division used in censuses)

	China	Japan	South Korea
Name	**Province (省级:省市)**		
Number	34		
Median pop.	37,327,378		
Max.pop.	104,303,132		
Min.pop.	3,002,166		
Name	Prefecture (地级: 市州盟)	**Prefecture (都道府県)**	**Province (시도)**
Number	333	47	17
Median pop.	3,151,810	1,706,242	1,902,611
Max.pop.	14,047,625	13,159,388	11,379,459
Min.pop.	95,465	588,667	531,905
Name	**County (县级:县市区)**		**Municipality (시군구)**
Number	2,856		302
Median pop.	379,869		201,070
Max.pop.	2,226,017		9,417,766
Min.pop.	251		7,764
Name	Township (乡级:乡镇街道)	**Municipality (市区町村)**	Sub-municipality (읍면동)
Number	40,906	1,901	3,472
Median pop.	40,577*	30,498	10,311
Max.pop.	373,094*	877,138	121,301
Min.pop.	2,705*	201	101

* Due to the data limitation, median, max and min population of Township level of China is that of Jiangsu Province.

Source : Population census statistics of 2010 for Provincial level of China, population census statistics of 2010 compiled by www.citypopulation.de for Prefectural level of China, statistics of 2007 of Ministry of Public Security (2008) and compiled by www.datatang.com for County level of China, statistics of 2004 by Statistics Bureau of Jiangsu Province (2005) for Township level of Jiangsu Province, China; population census statistics of 2010 for Japan and South Korea

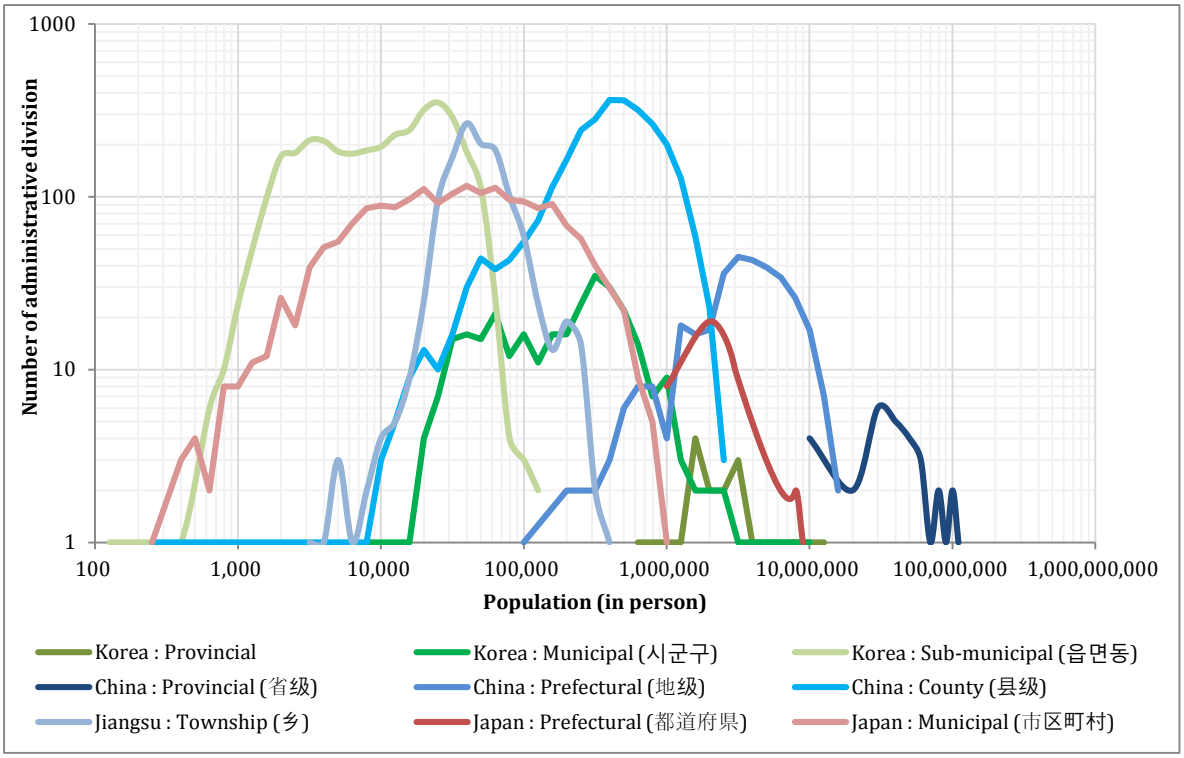

Figure 4 Population size distribution by different level of administrative division of China, Japan and South Korea

Source : Same as Table 1.

Methods

There are a few points to consider for the comparison of mobility indicators between three countries. Firstly the selected indicators are expressed so that it will be understandable intuitively. The indicator on lifetime mobility related to the birth or on immobility of minor administrative division are expressed in the way that the value increases when the people stay and do not move. However, to calculate a single, integrated indicator of mobility, the increment should be set in the same manner in all the indicators. Thus, the lifetime and immobility indicators' value are transformed as 1-*x*(%) ("1-*x*" row in Table 2).

Secondly the size and number of different administrative divisions should be standardized. On this aspect, Courgeau (1973) found out that there is a unique value *K* which expresses the level of mobility regardless of the division of a territory. Based on the hypothesis that people move inversely proportional to the square of the distance, supposing simple territory division and also using empirical data, it has been suggested the *K* is expressed as follows;

$$K = \frac{M}{\log N}$$

where *M* is mobility rate, expressed as the number of migrants divided by the total population, *N* is the number of administrative division of which migrants are counted

when crossing the border. Courgeau's *K* is widely used in the study of international comparison of internal migration (Bell 2009, UN 2013). Here in this study, *K* value is calculated when the administrative division is involved, using 1-*x* value as *M* and the number of administrative division of three countries as shown in Table 1.

Lastly, it is preferable to have a single index to represent the level of mobility of a country. With all 9 indicators, there is always corresponding Japanese value. The value of China or South Korea is calculated in relation to the Japanese value, and listed in the rows of *vs.Japan* then the synthetized unique mobility index of each country is calculated simply as the average of 9 indicators' *vs.Japan* value.

Results

There are only 3 indicators available in China whereas all 9 indicators are available in both Japan and South Korea. The data of China is limited only to the indicators which use the administrative division.

All the values calculated are listed in Table 2. The mobility index of China is 0.475, around half of that of Japan, and the mobility index of South Korea is 2.196, the double of that of Japan.

Concerning the low mobility of China, a further clarification might be needed. As already explained in Methods section, the size of the country and number of administrative division is already adjusted using Courgeau's K method, and still the Chinese mobility rate is lower than Japan or South Korea. Further, even if one would assume that minor administrative division of China is the same level as major administrative division of Japan and South Korea, still Chinese rate ("Birth in the same minor administrative division") is 83.0%, higher (less mobile) than the rates of Japan (71.7%) or South Korea (46.6%) of "Birth in the same major administrative division". There might be also a concern that the Chinese census data omits floating population who are not registered in household register and who do not respond to the census. However, the same census asked about the location of household register and as much as 261 million people, 20.8% of total population of China, responded that they are living outside of the household register location, which means that the census covered a good amount of the floating population in 2010. There can be more floating population or completely unregistered and uncounted people, but as the author does not possess further information with certainty, it is assumed here that the census data is close to the reality, in terms of floating population. The magnitude of floating population will be discussed separately later in the next section.

Table 2 Mobility indicators of China, Japan and South Korea

Name of indicator	Country	China	Japan		South Korea
	Source	2010Census	2010Census	2011NSM-J	2010Census
The same residence at birth	rate (%)			22.1	7.8
	1-*x*			77.9	92.2
	vs.Japan			*1.000*	*1.184*
Birth in the same minor administrative division	rate (%)	83.0		47.5	40.6
	1-*x*	17.0		52.5	59.4
	K	2.14		6.96	10.95
	vs.Japan	*0.307*		*1.000*	*1.574*
Birth in the same major administrative division	rate (%)	92.0		71.7	46.6
	1-*x*	8.0		28.3	53.4
	K	2.28		7.36	18.85
	vs.Japan	*0.310*		*1.000*	*2.562*
5 year mobility	rate (%)		22.8		51.0
	vs.Japan		*1.000*		*2.236*
5 year mobility of major admin. division	rate (%)	4.6	6.2		12.0
	K	1.31	1.62		4.25
	vs.Japan	*0.809*	*1.000*		*2.632*
5 year immobility of minor admin. division	rate (%)		87.2		81.1
	1-*x*		12.8		18.9
	K		1.69		3.49
	vs.Japan		*1.000*		*2.065*
1 year mobility	rate (%)			9.4	18.1
	vs.Japan			*1.000*	*1.930*
1 year immobility of major admin. division	rate (%)			1.7	4.2
	K			0.45	1.49
	vs.Japan			*1.000*	*3.440*
1 year mobility of minor admin. division	rate (%)			96.0	93.5
	1-*x*			4.0	6.5
	K			0.53	1.20
	vs.Japan			*1.000*	*2.252*
Mobility Index		***0.475***	***1.000***		***2.196***

Discussions

Chinese data on the household register separation (人户分离) or floating population

There are three kinds of questions regarding mobility in 2010 Chinese census but only the two, place of birth and usual residence 5 years ago, were used for the above comparison. However, the published tables using these two questions are quite limited. The remaining one question, on the status of household register, or more

specifically, if the person is living apart from the place of household register, provides many publish tables including age and sex dissagregations and other parameters.

In China, every person is registered in household register with name, sex, ethnic group, date of birth and other relevant information. There are 2 types of register, urban and rural, and it is difficult to change especially from rural to urban type (Chan 2013). This restriction of changing register was strict during the period from 1958 to 1984 but relaxed since the latter half of 1980's to a certain level (Yan 2005). Those who are living apart from the place of household register are called "floating population (流动人口)" or in the status of being separated from household register (人户分离, hereinafter referred to as "household-register separation").

Unlike standard question on mobility such as place of birth or residence 5 years ago, the data on floating population do not include those who moved and successfuly registered in the new address. Chan (2012) quotes such registered migration numbers published by the Ministry of Public Security which had been stable at around 20 million persons per year for the period from 1982 to 2008. With the total populaton of 1.3 billion, it corresponds to the annual rate of 1.5% of total population who officially moved and changed address, which can be considered rather low.

Contrary to the registered migrants, there were as much as 261 million floating population, or 20.8% of total population who lived in the status of household-register separation, according to the 2010 census data. When we observe the age-specific rate of household-register separation (Figure 5), the rate is extremely high around 20 year old then gradually decreases with age. For the 15 to 26 years old, the rate for female is higher than that of male and then the male rate is substantially higher in the mid 30's and 40's of age. For the elderly, especially more than 85 years old, there is an increase of rate, probably due to the care migration.

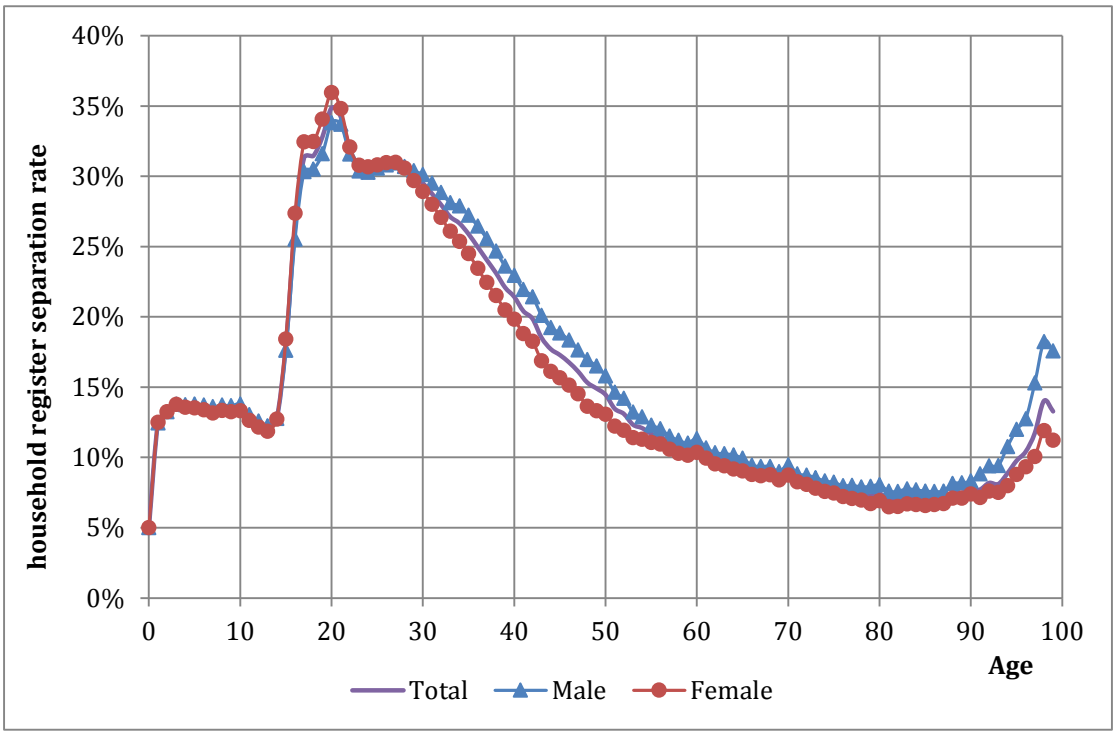

Figure 5 Age-specific household-register separation rate, China, 2010
Source : Population Census of China

Considering the nature of household-register separation rate, which is calculated using the number of people who live outside of their original household register unit of Township level, the most similar indicator available for Japan and South Korea would be the indicator of lifetime minor administrative division mobility, Municipality level for Japan and Municipality level for South Korea. As we have already examined in Table 1, the equivalent administrative level for South Korea would be Sub-municipality level, but as the mobility data of this level is not available, Municipality level indicator was used. The difference between the Chinese rate and the rates of Japan and South Korea can be caused by those Chinese citizens who moved but successfully registered his/her migration, which is rather small, as we have seen earlier.

When we compare the age-specific rate (Figure 6), it is observed that Chinese rate is much lower than that of Japan and South Korea. Also the form of the curve is different. The very low and stable rate of children up to 14 years of age suggests that parents who have children of that age would not migrate, or would not bring children with them when they migrate without the registration. Around the age of 20's, Chinese rate hits the peak at around 35%, but this rate is significantly lower than the rates of Japan (around 45%) or South Korea (around 55%). Later, both Japanese and South Korean rates keep on increasing until around in the 50's but Chinese rate decreases rapidly from the 30's. There can be several reasoning for this. First, some

might successfully acquire the new household registration and no more counted as floating population. Secondly, after they worked, they move back to their household registered place. Thirdly, simply they did not move out of household register location when they were younger, either by the fact that they did not need to move out or they could not because of stricter migration control in the past.

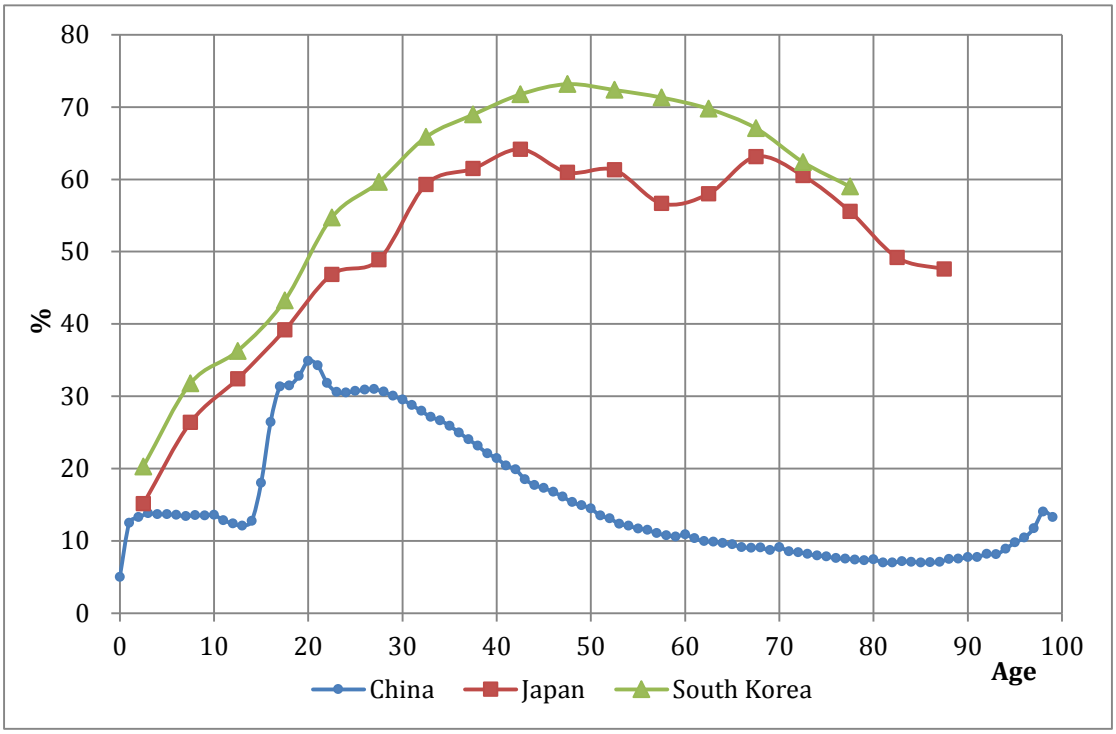

Figure 6 Age-specific household register separation rate (China) and lifetime minor administrative division mobility (Japan 2011, South Korea 2010)

Source : Census for China and South Korea, National Survey on Migration for Japan

Considering the scarcity of information, these interpretations remain only as speculation, but nevertheless, it seems that magnitude of Chinese floating population is still modest compared to the level of mobility of Japan or South Korea, when we compare the rates, not absolute number.

Extreme high mobility of South Korea

Three countries comparison revealed that South Korean move a lot, twice as much as Japanese and 4.6 times as much as Chinese. In other words, South Korean 5 year mobility in 2010 was 51.0%, meaning that 1 in 2 South Korean were living in different house 5 years ago in 2005. In another study, the author found out that South Korea is the world third most mobile country after Australia and Switzerland (Hayashi 2014).

Migration rate is heavily dependent on age, with a peak found among the young people in their 20's to 30's. To avoid the population structure influence, age-specific 5 year mobility and 5 year mobility of major administrative division (who moved across the Japanese Prefectural or South Korean Provincial border since 5 years ago) are calculated and compared (Figure 7). In all age brackets, Korean mobility is higher than Japanese. This is particularly notable for the total 5 year mobility rather than 5 year mobility of major administrative division, meaning that the Korean moves are much more concentrated on shorter distances.

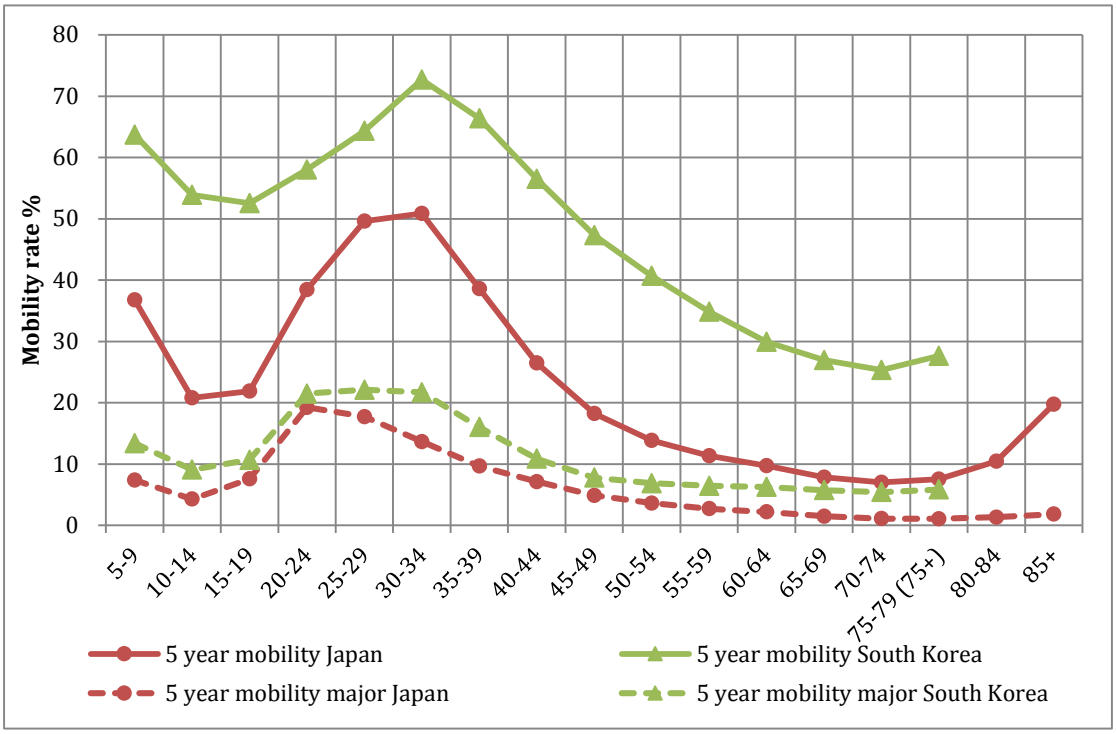

Figure 7 5 year mobility in Japan and South Korea by age

Note : "5 year mobility major" signifies 5 year mobility of major administrative division
Source : Census 2010 of Japan and South Korea

When we observe the historical trend of South Korean mobility (Table 3), although the published statistics on 5 year mobility up to 2000 is only for the move between municipalities, not including the move within municipality, the number of migrants as well as mobility rate of all categories show the same trend, increasing from 1970 to 1990 then decreasing to 2010.

In 2010 statistics, the big portion of South Korean mobility is found in the moves within municipality. Whether this "neighbourhood move" had been decreasing since 2000 is not known due to the data limitation, but different mobility indicator of a same country normally shows similar trend, we might be able to assume that the total mobility in South Korea in the 1990's is even higher than in 2010.

Table 3 Trend of 5 year mobility in South Korea

5 year mobility		1970	1980	1990	2000	2010
Migrants	**Total between Municipalities**	**4,394**	**7,658**	**9,871**	**9,711**	**8,234***
	Within Province, between Municipalities	1,918	3,879	4,380	4,191	3,120
	Between Provinces	2,457	3,739	5,435	5,386	5,083
	Other	20	40	55	134	338
Mobility Rate (%)	**Total between Municipalities**	**16.2**	**22.8**	**24.6**	**23.1**	**18.1**
	Within Province, between Municipalities	7.1	11.5	10.9	10.0	6.9
	Between Provinces	9.1	11.1	13.5	12.8	11.2

* “Total between Municipalities” in 2010 includes unknown.
Source : Census of South Korea, the data from 1970 to 2000 is cited and compiled by Choi (2004)

Conclusions

The drastic change of the regional population distribution in South Korea, observed earlier in Figure 2, can be strongly related to the extremely high mobility of South Koreans. The internal migration volume has been decreasing since 1990, but still, as of 2010, the mobility level is very high.

Japanese move half than South Korean but more than Chinese in 2010, and the population concentration in regions around Tokyo continues, less rapid than in Seoul, though.

There is a common belief that the internal migration is immense in China. However, these arguments, especially in the media, are quoting the absolute number of migrants, not the rate, with no cross-country comparative perspectives. This article performed the quantitative comparison and concludes that the level of mobility in China is half of Japan and 1/4 of South Korea. This can be the reason that the population concentration is not as apparent in China.

Considering the large size of China, population distribution should be examined at smaller levels. It should be verified if the intra-provincial population distribution might be unequal or not.

Migration itself is good or bad. Some would feel happy to move, and some would feel happy to stay. However, when people move for a job, it will create wealth, rather than staying and doing nothing. It had been already shown that the mobility level is highly correlated with the level of economic development (Bell 2013, Hayashi

2014). Although the causality is not known, it is worth trying to analyse further the interrelationship between the mobility and underlying factors.

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