Changes in family structure in China: the impact of residence patterns and demographic factors

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Received: 26 September 2018 / Accepted: 22 December 2018 / Published online: 31 January 2019
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Abstract

Based on census data from China, this paper uses SOCSIM microscopic simulation method to decompose the key factors of family transition into demographic and residence pattern factors. The former are further broken down into demographic inertia, fertility, mortality and marriage rate. The results indicate that the current demographic changes are relatively small and, thus, the small fluctuations caused by demographic changes contribute much less than residence pattern to the family transition. Among the demographic factors, demographic inertia and fertility have a greater effect on family transition and the impacts caused by fertility and marriage rate are consistent with the direction of the overall influence of demographic factors: increasing the proportion of single-person households, one-generation households, and two-generation households, and decreasing the proportion of three-generation or more households. In contrast, the effect of mortality rate was opposite to that of fertility rate, which increased the proportion of populations living in single-person, one-generation, and two-generation households, but the decreased the proportion of the population living in three-generation or more households.

Keywords Family transition · SOCSIM microscopic simulation · Demographic factors · Residence pattern factors

1 Introduction

Family size and family structure reflect the status of a family from both quantitative and qualitative perspectives. As social and economic development move forward in China, the structure of Chinese families has undergone continuous changes. During the decades following the founding of New China, the impacts of the cooperative

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movement and socio-economic development were behind significant changes to the types and the intergenerational structure of Chinese households. In the year 2000, China's family structures could be divided into several categories, including relatively stable families (such as three-generation households), emerging families (such as single-person households, grandparent headed household) and diminishing families (such as impaired nuclear families) (Wang 2006). In 2010, the cumulative proportion of one-generation and two-generation households exceeded 80%, with the proportion of one-generation households going up 11% from 2000 and that of two-generation households going down 10% from 2000 (Hu and Peng 2014). According to Western theories of family modernization, family transition is influenced by both socio-economic factors and demographic factors. Socio-economic factors determine people's residence patterns refers to the agent variable of economic and social factors and take into consideration issues such as attitudes and dwelling conditions; these factors lead directly to family transition. Demographic factors have major impacts on family size and structure (Jiang and O'Neill 2007). In particular, demographic factors such as fertility and mortality have a significant impact on family structure and kinship (Hammel 2005).

In view of this, this paper first divides the factors influencing the transition in family structure into two types (demographic factors and residence patterns), and then further breaks down the demographic factors into demographic inertia, fertility rate, mortality rate and marriage rate in an effort to explore their specific impacts. Specifically, the paper applies the SOCSIM microscopic simulation method¹ to data from the first to the sixth national census in China to analyze family structures in the past decades, and then studies how and to what extent different factors have contributed to the transition of family structures.

2 Impacts from demographic factors and residence patterns

We use D_{effect} to imply the effect of demographic factors (D refers to the total population) and P_{effect} to imply the effect of residence patterns (P refers to the proportion of population groups with different residence patterns to the total population). By multiplying the D vector by the P vector which falls within the same time range, we obtain the size of the population group adopting its residence pattern in the time range under consideration, namely:

$$h_t = f(D_t, P_t) = D_t * P_t$$

When the factors are decomposed, the effect of demographic factors is shown as the variation in h after controlling the residence pattern (P_{effect}), and the effect

¹ The SOCSIM microscopic simulation method developed by Eugene A. Hammel and Kenneth W. Wachter in the 1970 s has been in use for nearly 40 years, during which time continuous support has been provided by the National Institute on Aging, the National Science Foundation and the National Institute of Child Health and Human Development. There are reviews of the microscopic simulation of population in the book *Family Demography* (edited by Bongaarts, Burch and Wachter) and in an article written by Devos and Palloni. The article has been included in the Population Index.

Fig. 1 The proportion of population living in different households, 2000 and 2010. Source: 2000 and 2010 Census

of residence pattern is the variation in h after controlling the demographic factors (D_{effect}). The formulas are as follows:

$$D_{effect} = \frac{(D_1 * P_1 - D_2 * P_1) + (D_1 * P_2 - D_2 * P_2)}{2} \quad (1)$$

$$P_{effect} = \frac{(D_1 * P_1 - D_1 * P_2) + (D_2 * P_1 - D_2 * P_2)}{2} \quad (2)$$

where h_1 , D_1 and P_1 refer, respectively, to the size of the population living in a certain type of household, the total population and the proportion of the population living in this type of household at the first time-point; h_2 , D_2 and P_2 refer, respectively, to the size of the population living in a certain type of household, the total population and the proportion of the population living in this type of household at the second time-point.

Taking single-person households as an example, we analyzed the change in the proportion of the population living in single-person households from 2000 to 2010, and found that the proportion doubled from 2.40% in the Fifth Census in 2000 to 4.95% in the Sixth Census in 2010. Based on the previous analysis, first this paper assumes that the proportion of the population living in single-person households in 2010 is the same as that in 2000, namely 2.40%, and the population size changes are based on the actual situations (Fig. 1). We then subtract the size of the population living in single-person households in 2000 ($D_{2000} * P_{2000}$) from the size of that population in 2010 ($D_{2010} * P_{2000}$) to analyze the effect of demographic transition on the basis of the proportion in 2000 ($D_{2010} * P_{2000} - D_{2000} * P_{2000}$). Next, the paper assumes that the proportion of population living in single-person households in 2000 is the same as that in 2010, namely 4.95%, and the population size changes are based on actual situations. We then subtract the size of population living in single-person households in 2000 ($D_{2000} * P_{2000}$) from the size of that population in 2010 ($D_{2010} * P_{2000}$) to analyze the effect of demographic transition on the basis of the proportion in 2010 ($D_{2010} * P_{2000} - D_{2000} * P_{2000}$). Subsequently, the two

Table 1 Decomposition of demographic factors and residence pattern factor that lead to family transition, 2000–2010 (%). Source: 2000 and 2010 Census and SOCSIM microscopic simulation

	Single-person household	One-generation household	Two-generation household	Three-generation or above household
Overall variation	2.55	5.81	−6.32	2.91
Demographic factors	0.07	2.75	1.29	−1.58
Residence pattern	2.48	3.06	−7.61	4.49

differences are summed and averaged to obtain the proportion of the variation in the size of population living in single-person households to the total variation caused by the demographic factors. Finally, the paper multiplies this proportion by the variation (−1.70%) in the proportion of the population living in single-person households from 2000 to 2010 to locate the part of the variation from 2000 to 2010 that is caused by the demographic factors. In the same way, we can calculate the extent of the effect of the residence pattern variable on the proportion of the population living in single-person households when the demographic factors are controlled.

Using the same method, principle and process, the paper decomposes the demographic factors and residence pattern factor based on the variations in the proportions of the population living in single-person, one-generation, two-generation and three-generation or above households from 2000 to 2010 (see Table 1). In general, during the period from 2000 to 2010, we find that for changes in the proportions of all types of households the effect of the change in residence pattern is generally greater than the effect of the changes in demographic factors.

From 2000 to 2010, the proportion of the population living in single-person households increased by 2.55%, of which 2.48% was caused by change in residence patterns; demographic factors only made a minor contribution to the change in proportion. It can be concluded that residence pattern has the greatest impact on people's choice to live alone. Among demographic factors, the gender difference in the mortality rate of the elderly population and the change in marriage rate will have certain impacts on the proportion of the population living in single-person households, but such changes are mainly determined by residence pattern. Unmarried or widowed people may choose to live with their parents or children. Therefore, the change in residence pattern plays a very important role in the changing proportion of single-person households.

The proportion of the population living in one-generation households increased by 5.81% from 2000 to 2010, and there was little difference between the effect of residence pattern and that of demographic factors on this increase. Among the demographic factors, the postponement of childbearing has led to an increase in the proportion of the population living in one-generation households. The effect of residence pattern was slightly greater than that of demographic factors. Whether or not to choose to live with the previous or the next generation can make a major difference on the proportion of the population living in one-generation households.

As part of the process of family nuclearization, the proportion of two-generation households decreased, with the proportion of the population living in two-generation households going down by 6.32% from 2000 to 2010. Residence pattern was the only contributor to this decline; in fact, demographic factors had an opposite effect, increasing the proportion of the population living in two-generation households. The postponement of childbearing among married couples living with their parents and the late marriages of adult children increases the proportion of the population living in two-generation households. On the other hand, the proportion of three-generation households as a household type has decreased slightly, and yet the increase in total size of the population has led to an increased proportion of the population living in three-generation households. Residence pattern had a significant impact on this change while demographic factors had a relatively minor effect. It can be seen that residence pattern has contributed a great deal to family transition. A booming economy and rapid social change during the years 2000 to 2010 led to a major shift in attitudes toward residence patterns and an improvement in housing conditions. The result of this was a major shift in preferred residence patterns, and this has had a significant impact on family transition. On the other hand, demographic transition was relatively stable during the period from 2000 to 2010, and contributed less to family transition as a result of this stability.

2.1 Further decomposition of the effect of demographic factors

In this section, the paper decomposes the demographic factor into fertility rate, mortality rate, marriage rate and other aspects of demographic inertia. Different from the decomposition of demographic factors and residence patterns, the analysis of the impact of fertility rate, mortality rate and marriage rate needs to maintain these rates at levels of last time period and project the population status (i.e., D vector) under these rates. On this basis further analysis is carried out by taking account of the proportions of respective residence patterns (i.e., P vector). The population vector D is a function of fertility rate (F), mortality rate (M) and marriage rate (N), namely:

$$D = g(F, M, N)$$

Taking the fertility influencing factor (F_{effect}) as the example, under two scenarios in which the fertility rate is kept unchanged at the previous level (F_{fix}) and changes as per the actual situations (F_{chg}), SOCSIM projects the difference in population size ($D_{fix-chg}$) and multiplies it by residence pattern (P) to obtain the variations in the sizes of the populations living in different households. With regard to the vector of the residence pattern, this paper uses the mean value before and after the period (P_{avg}). In the decomposition of its effect on fertility rate, we must also pay attention to the effects of different scenarios for mortality rate and marriage rate variations. This paper uses SOCSIM to perform eight simulations to calculate the variations in demographic factors as caused by the fertility rates in the four scenarios. Specifically:

1. The population difference caused by the change in fertility rate when the mortality rate and marriage rate are kept unchanged at the previous level:

2. The population difference caused by the change in fertility rate when the mortality rate and the marriage rate change pursuant to the actual situations:
- $$g(F_{fix}, M_{fix}, N_{fix}) - g(F_{chg}, M_{fix}, N_{fix})$$

ity rate and the marriage rate change pursuant to the actual situations:

3. The population difference caused by the change in fertility rate when the mortality rate is kept unchanged at the previous level and the marriage rate changes pursuant to the actual situations:
- $$g(F_{fix}, M_{chg}, N_{chg}) - g(F_{chg}, M_{chg}, N_{chg})$$

ity rate is kept unchanged at the previous level and the marriage rate changes pursuant to the actual situations:

4. The population difference caused by the change in fertility rate when the mortality rate changes pursuant to the actual situations and the marriage rate is kept unchanged at the previous level:
- $$g(F_{fix}, M_{chg}, N_{fix}) - g(F_{chg}, M_{chg}, N_{fix})$$

ity rate changes pursuant to the actual situations and the marriage rate is kept unchanged at the previous level:

$$g(F_{fix}, M_{chg}, N_{fix}) - g(F_{chg}, M_{chg}, N_{fix})$$

On the basis of the results obtained under different scenarios, the population differences are multiplied by the mean value of residence pattern, divided by the corresponding value, and finally summed up. In this way, we can obtain the variation (i.e., F_{effect}) in the size of population living in a certain type of household during such a period when the fertility rate changes. The specific formula is as follows:

$$\begin{aligned}
 F_{effect} = & \frac{[g(F_{fix}, M_{fix}, N_{fix}) - g(F_{chg}, M_{fix}, N_{fix})] * P_{avg}}{3} \\
 & + \frac{[g(F_{fix}, M_{chg}, N_{chg}) - g(F_{chg}, M_{chg}, N_{chg})] * P_{avg}}{3} \\
 & + \frac{[g(F_{fix}, M_{fix}, N_{chg}) - g(F_{chg}, M_{fix}, N_{chg})] * P_{avg}}{6} \\
 & + \frac{[g(F_{fix}, M_{chg}, N_{fix}) - g(F_{chg}, M_{chg}, N_{fix})] * P_{avg}}{6}
 \end{aligned} \quad (3)$$

Similar to the fertility influencing factor (F_{effect}), the mortality influencing factor (M_{effect}) is calculated using the following formula:

$$\begin{aligned}
 M_{effect} = & \frac{[g(F_{fix}, M_{fix}, N_{fix}) - g(F_{fix}, M_{chg}, N_{fix})] * P_{avg}}{3} \\
 & + \frac{[g(F_{chg}, M_{fix}, N_{chg}) - g(F_{chg}, M_{chg}, N_{chg})] * P_{avg}}{3} \\
 & + \frac{[g(F_{fix}, M_{fix}, N_{chg}) - g(F_{fix}, M_{chg}, N_{chg})] * P_{avg}}{6} \\
 & + \frac{[g(F_{chg}, M_{fix}, N_{fix}) - g(F_{chg}, M_{chg}, N_{fix})] * P_{avg}}{6}
 \end{aligned} \quad (4)$$

Similarly, the marriage rate influencing factor (N_{effect}) is calculated using the following formula:

$$N_{effect} = \frac{[g(F_{fix}, M_{fix}, N_{fix}) - g(F_{fix}, M_{fix}, N_{chg})] * P_{avg}}{3} + \frac{[g(F_{chg}, M_{chg}, N_{fix}) - g(F_{chg}, M_{chg}, N_{chg})] * P_{avg}}{3} + \frac{[g(F_{fix}, M_{chg}, N_{fix}) - g(F_{fix}, M_{chg}, N_{chg})] * P_{avg}}{6} + \frac{[g(F_{chg}, M_{fix}, N_{fix}) - g(F_{chg}, M_{fix}, N_{chg})] * P_{avg}}{6} \quad (5)$$

Taking single-person households as the example, the previous analysis pointed out that the proportion of the population living in single-person households to total population increased by 2.55 percentage points from 2000 to 2010. The demographic factors contributed 0.07 percentage points from 2000 to the increase in the proportion of the population living in single-person households. We further decompose the demographic factor effect into the effects of fertility rate, mortality rate, marriage rate and demographic inertia. Based on the effect of fertility rate, the following formula is obtained by referencing the above formulas:

$$F_{effect} = \frac{[g(F_{2000}, M_{2000}, N_{2000}) - g(F_{2010}, M_{2000}, N_{2000})] * P_{avg}}{3} + \frac{[g(F_{2000}, M_{2010}, N_{2010}) - g(F_{2010}, M_{2010}, N_{2010})] * P_{avg}}{3} + \frac{[g(F_{2000}, M_{2000}, N_{2010}) - g(F_{2010}, M_{2000}, N_{2010})] * P_{avg}}{6} + \frac{[g(F_{2000}, M_{2010}, N_{2000}) - g(F_{2010}, M_{2010}, N_{2000})] * P_{avg}}{6}$$

The proportion of population living in the single-person households (P) is the mean value of 2000 and 2010, namely $P_{avg} = 3.67$. The F_{effect} obtained is divided by the D_{effect} to get the proportion of the effect of fertility rate to the overall effect of demographic factors. Then, we multiply this proportion by the change brought about by the demographic factors (i.e., 0.07) to obtain the effect of fertility rate.

Using the same method, principle and process, changes in the proportion of population living in single-person, one-generation, two-generation and three-generation or above households from 2000 to 2010 are decomposed into demographic inertia, fertility rate, mortality rate and marriage rate (see Table 2). The effect of demographic factors on family transition during the period from 2000 to 2010 has been analyzed in the previous section. The findings showed the proportions of population

Table 2 Decomposition of demographic factors that lead to family transition, 2000–2010 (%) Source: 2000 and 2010 Census and SOCSIM microscopic simulation

	Single-person household	One-generation household	Two-generation household	Three-generation or above household
Demographic factors	0.07	2.75	1.29	– 1.58
Population inertia	– 0.15	2.71	– 2.86	6.70
Fertility rate	0.21	0.04	3.96	– 7.91
Mortality rate	– 0.04	– 0.01	– 0.81	1.61
Marriage rate	0.05	0.01	0.99	– 1.98

living in single-person, one-generation, two-generation and three-generation or above households changed by 0.07%, 2.75%, 1.29% and – 1.58% respectively during the years from 2000 to 2010. Next, we will analyze the specific changes in detail.

The change in fertility rate from 2000 to 2010 increased the proportions of the population living in single-person, one-generation and two-generation households by 0.21, 0.04 and 3.96%, respectively, but decreased the proportion of the population living in three-generation or above households by 7.91%. It can be seen that fertility rate influences family transition in the same way that demographic factors affect family transition. During the period from 2000 to 2010, the change in fertility rate increased the proportions of the populations living in single-person, one-generation and two-generation households, but reduced the proportion of the population living in three-generation or above households.

With the decline in the fertility rate and childbearing postponement, a relatively large number of young married couples form single-couple nuclear families and this increases the proportion of one-generation households. There is a drop in the children number of one family along with the decline in fertility rate. As increasingly few children leave their families, the time at which families enter the empty-nest stage is moved forward, and the duration of the empty-nest stage is extended, thereby increasing the proportion of one-generation households. However, comparatively speaking, the change in fertility rate has had a minor effect on changes in the proportions of single-person and one-generation households, but significant impact on two-generation and three-generation households. The difficulties obtaining suitable housing and the convenience of daily life have made some young couples decide to live with their parents. In addition to being a factor causing an increase of the proportion of the population living in two-generation households (young couples living with their parents), the decline in fertility rate has also reduced the proportion of the population living in three-generation or above households.

Next, the effect of mortality rate is decomposed. The change in mortality rate in the period from 2000 and 2010 reduced the proportions of population living in single-person, one-generation and two-generation households by 0.04%, 0.01% and 0.81%, respectively, but increased the proportion of population living in three-generation or above households by 1.61%. In fact the effect of mortality rate on demographic transition was opposite to that of fertility rate, which increased the

proportion of populations living in single-person, one-generation, and two-generation households, but the decreased the proportion of the population living in three-generation or more households.

Theories of family transition point out that fertility rate and mortality rate have a combined effect on family transition, i.e., the two jointly affect family transition. In the process of China demographic transition, the mortality rate has dropped from an initially high level to its presently low level. After the infant mortality rate drops to a certain level, change in the mortality rate of the elderly becomes the principal factor affecting mortality change. Decline in the mortality rate of the elderly, especially the decline in the mortality rate of elderly men, leads to a decrease in the size of the widowed elderly population, thereby reducing the proportion of the population living in single-person households. The decline in the elderly mortality rate also extends the time the elderly may live with their children, and this also reduces the proportion of the population living in single-person households. The change in mortality rate has a relatively minor effect on single-person and one-generation households, but a significant impact on two-generation and three-generation or above households. The decline in the elderly mortality rate has extended the time that the elderly can live with their children and grandchildren, thereby reducing the proportion of the population living in two-generation households and increasing the proportion of the population living in three-generation or above households.

According to theories on family transition, demographic factors affect not only fertility rate and mortality rate, but the marriage rate as well. In its decomposition of demographic factors, this paper also analyzes the marriage rate separately. The change in marriage rate in the period from 2000 to 2010 increased the proportion of the population living in single-person, one-generation and two-generation households by 0.05%, 0.01% and 0.99%, respectively, but decreased the proportion of the population living in three-generation or above households by 1.98%. The marriage rate affected the proportions of populations living in all four household types in the same way the fertility rate and demographic transition factors did.

Late marriage and overall decline in the marriage rate have increased the proportion of the population living in single-person households and the probability that unmarried children continue to live with their parents, thereby increasing the proportion of the population living in two-generation households. Late marriage has also resulted in childbearing postponement, which in turn reduces the proportion of the population living in three-generation households.

We understand that the inertia of the population itself has a great impact on the demographic transition. Therefore, when decomposing the effects of demographic factors on family transition, after excluding the effects of fertility rate, mortality rate and marriage rate, the remaining effect is that of demographic inertia. Demographic inertia has reduced the proportions of the populations living in single-person and two-generation households by 0.15% and 2.86%, respectively, and increased the proportions of the populations living in one-generation and three-generation or above households by 2.71% and 6.70%, respectively. It can be seen that during the period from 2000 to 2010, demographic inertia has a relatively large effect on the proportions of populations living in different types of households, but in some cases

increasing and in others decreasing the proportions of populations living in particular types of households.

3 Discussion and conclusion

This paper divides the causes of family transition into two aspects: residence pattern (the most direct cause) and demographic factors. From the decomposition results, we found that residence pattern has a greater effect on demographic transition than demographic factors. This is evidence that the residence choices of Chinese families are of crucial importance in determining family structure in Chinese society. As a matter of fact, during the period of booming development, Chinese society has gone through in recent years, people's attitudes toward certain things have changed rapidly. With regard to residence patterns, more and more young couples are choosing not to live with their parents after they become adults. This has a great impact on family transition. On the other hand, China's current demographic transition has shifted from the traditional pattern featuring "high fertility, high mortality and low population growth" to a new pattern characterized by "low fertility, low mortality and low population growth", and has entered a relatively stable stage. The result of this shift is that, compared to residence pattern, demographic factors are having a relatively weaker impact on family transition.

According to modern Western theories of family transition, fertility rate, mortality rate and marriage rate all have an impact on family transition. In this paper, these three factors are decomposed from demographic factors and examined individually. The results demonstrate the interaction between fertility rate and mortality rate in affecting family transition, and shows that the "combined" effects of the two are actually "conflicting" effects. Marriage and childbearing are interconnected, and in China the effect of marriage on family transition is consistent with the effect of childbearing. It should be emphasized that in China, fertility level is largely determined by fertility policy, and in the future further, in-depth study must be carried out to analyze the effects of the "selective two-child policy" and "universal two-child policy" on the changes in family structure. How can the coverage of current family services be expanded in the future so they better contribute to family development? This shall become a target of the future work of government authorities (such as the newly established Family Development Department of the National Health and Family Planning Commission).

Today, we cannot ignore the impacts of family transition on the development of important consumer markets. Plans to develop housing and urban planning in general must take family transition into consideration. Planners much also be aware of the impacts of family transition on demands for education, and medical and health care. Moreover, most Chinese people have traditional attitudes towards support of the elderly, believing such support should come primarily from the family. The transformation in family structure is certain to have an impact on the development elderly support patterns and the care service industry for elderly people. Therefore, continuous research on the influencing factors (and corresponding mechanisms) of the transformation in family structure is of vital significance for China to promote

the development of important consumer markets in the future (such as real estate planning and development of the elderly care service industry) and for the government to formulate relevant family policies in order to meet the society's reasonable expectations for stable development.

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