

An Analysis of the Marriage Squeeze Behavior in China Based on Multi-Agent Modeling

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Abstract. Due to the effect of the long-term family planning policy, the imbalance sex ratio at birth in China is very severe and the birthrate of male has been significantly higher than women, which almost inevitably cause the phenomenon of male marriage squeeze in future Chinese marriage market. This paper uses multi-agent modeling to build a first marriage market model to simulate the actual features in China. On this basis, we analyze the effect of marriage squeeze on choice behavior in first marriage market. Our simulation results show that the male marriage squeeze will affect the stability of the marriage market, which not only change the time of seeking a spouse in both male and female, but also affect the age difference between the spouses.

Introduction

Since the implementation of the family planning policy in 1970s in China, great changes have been made in the population growth rate, and a series of demographic problems have been produced. Especially, the girl often suffers from sex discrimination in Chinese rural areas and low fertility rate aggravates the sex ratio imbalance, which increase the gap between the number of men and women who reach the marriage age. These demographic problems reflect the changes in the Chinese marriage market structure and there is an increasingly serious phenomenon of male marriage squeeze.

In the Chinese related researches of marriage squeeze, Xianchao Guo [1], Jinhong Pan[2] and Xiaofeng Ni [3] et al. studied the changes in Chinese marriage pattern from the perspective of the marriage market, especially, the increasingly serious phenomenon of marriage squeeze. Shuzhuo Li[4] et al. analyzed the causes of male marriage squeeze from the son preference and discrimination against daughter. In the study of the scale of the Chinese marriage squeeze, Poston and Glover[5] estimated that the number of males in China is 23 million more than that of women from 1978 to 2000. The annual increase of overpopulation of male without spouse is over one million in China [6,7,9] et al. Some experts even believe that the population gap between Chinese male and female who simultaneously reach the marriage age will be more than 44 million in future [7].

According to the domestic and foreign research results, the research on the mechanism of Chinese individual marriage choice behavior is lack. Specifically, almost all studies lack detailed analysis about the process and the result of marriage squeeze. There is still short of systematic study about the marriage choice behavior from the micro-performance to the macro-system. This paper constructs simulation marriage market and studies first marriage age distribution, age difference, the average time of choosing a spouse under the conditions of the marriage squeeze.

Multi-agent Modeling in Marriage Market

Model Assumptions and Matching Rules

In this paper, multi-agent modeling method is used to simulate the marriage market using MATLAB programming. Its basic premises are as follows:

First, all the agents in the market are to eventually get married for the purpose; second, as first marriage market, we do not consider the divorce and remarriage, and the agent exits market when getting married or exceeding the age limit; third, considering the influence of social pressure, the agent's age will affect the preference of marriage, in brief, the preference of marriage will increase with age; fourth, all agents are rational who can be rational to judge their own value and recognize each other's value; Fifth, the more similar are the values between paired-agents, the more probability they get married, reflecting the marriage between families of equal social rank.

The design of attribute in simulation market includes the design of the market attribute parameters and the agent attribute parameters. The design of agent attribute parameters is as follows, all agents in market have the attributes of gender, age, personal value, preference and marriage preference etc. The personal value is divided into four parts, reflecting the personal appearance, family background, wealth and age value; preference is synthetical weight according to the measure of personal value. The marriage preference is the probability factor to determine whether agents can get married and the longer agents stay in the market, the more marriage preference they will have.

In the simulation market, the agents adopt the mechanism of the random encounter and the judgement of paired-agents. Each agent experiences the following steps: Firstly, each agent is assigned to a random position when has just entered the market. According to the position, the agent randomly chooses a heterosexual neighbors as potential spouse, then they mutually make value judgements between self-preference and other's value and the system calculates the value matching factor according to the difference between comprehensives value of paired-agents. At the same time, the system calculates the common marriage preference factor according each marriage preference and the probability of successful marriage between two agents that is the product of the value matching factor and the common marriage preference factor. If the pairing is successful, the paired-agents exit market, but if failed, the two agents move randomly and repeat the above procedure until they get married or reach the age limit.

Basic Parameter Description in Marriage Market Simulation

Considering the actual situation in the marriage market, we make our model obey the following settings:

(1) The initial personal value of the agents in the market reflect the various aspects of individual value, such as appearance, family background, education etc. which are independent and the normal distribution

(2) Considering the actual society, both men and women prefer to choose their spouses with similar age, income and education level. Let the value matching factor which affect the probability of successful marriage be real number from 0 to 1.

(3) The age value of agent varies between different gender and woman with the highest age value is younger than man, for example, the prime age for woman is 24 years old, and the prime age for man is 30 years old.

(4) The marriage preferences of all agents are only concerned with their own ages, the existence time of agent in the market and the marriage preference of agent satisfies the logistic curve, that is, the marriage preference is close to 1 after some time.

The Result of Marriage Market Simulation

The Simulation of Marriage Market Behavior under Non Marriage Squeeze

First, this paper assumes that the initial market has a population of 10000, where the male-to-female ratio is 1:1 and the age of each agent who exits the market after 30 years is risen by a year after her or his ten choices. Then we assume that the preference of agent for the personal value of her or his spouse is random and every new entrance agents has the equal male-to-female ratio

Fig.1 shows the distribution of age at first marriage for female and male by multi-agent simulation. Fig.2 is the distribution of age at first marriage arranged by sex from 1980 to 2010 in the long form data of the sixth national census in China, and the age ranges from 14 to 49 years old. The distribution of Fig. 1 after the age of 20 is very similar with Fig. 2. Considering that the initial agent age is 20 years old, our marriage market model is very close to the actual.

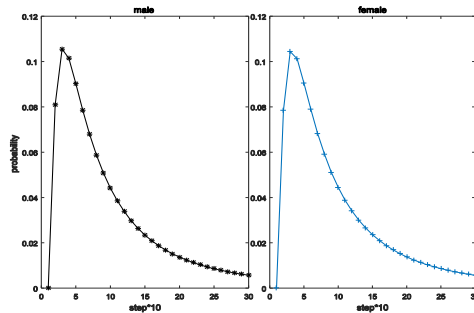


Figure 1. First marriage pattern ranged by sex under non marriage squeeze market.

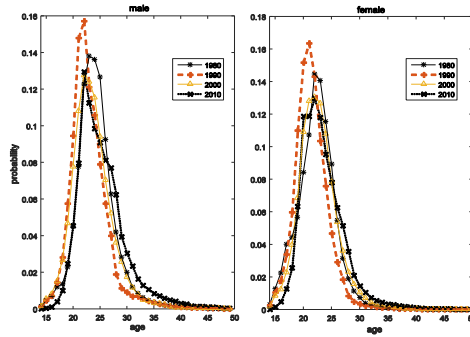


Figure 2. The distribution of age at first marriage ranged by sex from 1980 to 2010
 Data source: the 6th national population census data released by NBSC.

Analysis of Market Behavior under Marriage Squeeze Market

Fig.3 shows that the probability of marriage in every generation changes with male-to-female ratio varying from 1 to 2 and marriage squeeze change the average marriage rate of every generation in the market. With the increase of the degree of marriage squeeze, that is, the number of male population is much greater than female, the overall average marriage rate drops significantly, where the male marriage rate drops more obviously. when the male marriage squeeze reached the extreme in the model, that is, the male-to-female ratio is 2:1, the average marriage rate of male drops to 50%; with the marriage squeeze increasing and reaching 100%, the female domain the market completely.

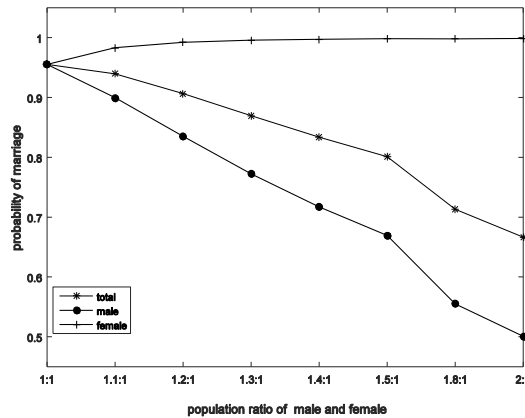


Figure 3. The probability of marriage ranged by sex in different marriage squeeze.

Along with the increase of the marriage squeeze, the marriage rate of different sex has changed significantly, and the time for the agent to get married has also changed obviously. Fig.4 shows that the time for the agent to get married changes under different sex and marriage squeeze, where the horizontal axis represents the different marriage squeeze and the vertical axis represents the ratio of the average time for the agent to get married under non marriage squeeze to that under marriage squeeze.

From Fig. 4, along with the increase of the marriage squeeze, the time for the female to get married plummets and levels off when the male-to-female ratio is 1.5:1, at this time, the female

cut the time needed to get married up to 40% compared with non marriage squeeze. The average time of matching successfully in the total population decreases slowly. Interestingly, the average marriage age of male decrease after the first increase, along with the increase of the male marriage squeeze, the time for male to get married increases gradually, but to a certain degree of marriage squeeze, the average time of male to finding a spouse gradually is shortened up to less than that in non marriage squeeze levels.

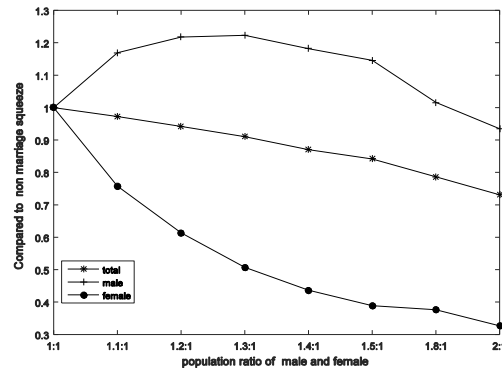


Figure 4. The time of successful matching ranged by sex in different marriage squeeze.

In short, the male marriage squeeze reduces the average time of marriage between male and female in the marriage market. With the increase of marriage squeeze, the age difference between the couple is very significant. Fig. 5 shows the distribution of the age difference between couples, where the horizontal axis represents the difference of time step between couples before they exit the market and the vertical axis is the percentage of population ranged by age difference. The couples with same age are almost not affected by marriage squeeze, but with the increase of the male marriage squeeze, the male is older than his spouse when getting married, and the age difference is growing.

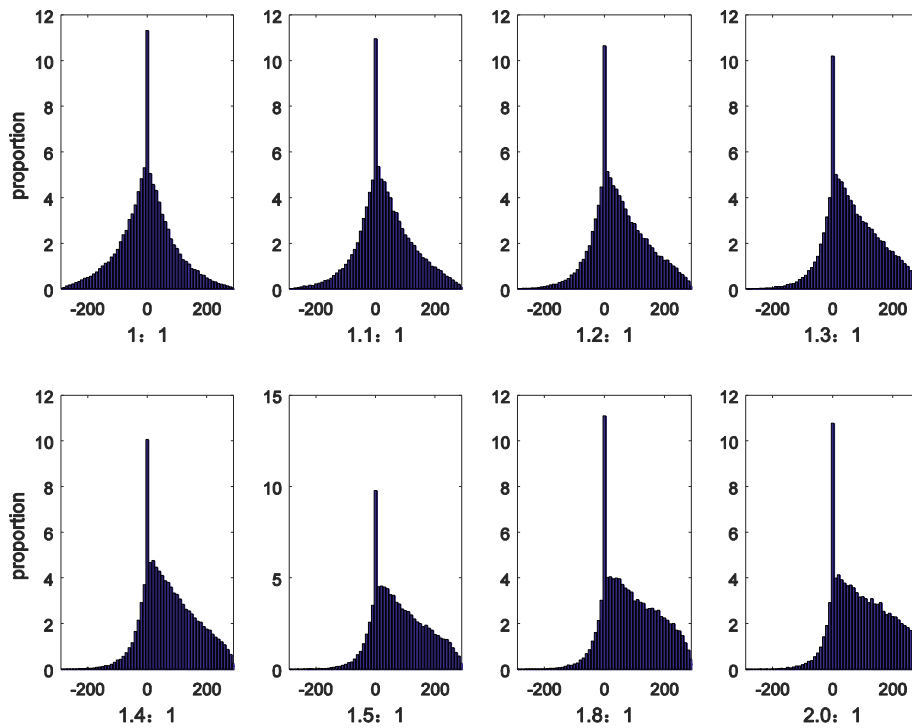


Figure 5. The distribution of age difference between couples in different marriage squeeze.

Conclusion

As a key research issue in demography, the phenomenon of marriage squeeze has been widely concerned. The current male marriage squeeze may cause serious structure problem in marriage market, which is difficulty in prevention and improvement by population policies. By using the method of multi-agent modeling, we establish the structure and rules of the marriage market through imitating the actual marriage market behavior, and can well simulate the micro-mechanism and macro statistical characteristics of the marriage market. On this basis, we discuss the structure and the statistical characteristics of the simulating marriage market under different male marriage squeeze. The study finds that the marriage market has dual attributes of log-normal distribution and power-law tail distribution under non marriage squeeze, which is very similar to the actual first marriage pattern. However, with the increase of the male marriage squeeze, the first marriage pattern suffers different shocks. Relatively speaking, the marriage market becomes the female market and the female agents have stable structure with similar distributions in the market, however, the male agents are affected greatly, with the characteristics change of the lognormal distribution and the power-law tail.

The phenomenon of male marriage squeeze, threatening the population structure and marriage market, has always been a social problem. The simulation results show it is the key problem to be solved urgently at present. Of course, this paper has some limitations, such as, we should perfect the mechanism of agent study, and we also do not take the difference between rural and urban areas into account, so our model needs further clarification of the inside mechanism.

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