Study on the Optimal Fertility Choice Based on Household Utility Function

WU Shandan[a],*

[a]School of Economics, Central University of Finance and Economics, Beijing, China.
*Corresponding author.

Abstract

Under the background of implementing the "two-child policy" in China, this paper builds the overlapping generation household utility model which includes the parents' salary level and their children's expected income level. This study finds that economic costs, the time of childcare and the household utility elasticity of consumption have negative impact on the household optimal fertility choice. The father's salary level, the household utility elasticity of child-bearing and the children's income elasticity of human capital investment have a positive effect on the choice of optimal childbirth while the impact of mother's salary level is uncertain. At the end of this paper, we put forward some suggestions on how to effectively promote the "two children's policy".

Key words: Universal two child policy; Household utility function; Optimal fertility choice

INTRODUCTION

Since the implementation of the "family planning" policy in the 1980s, China has maintained a low level of fertility. After 2015, the labor force born during the "Baby Boom" of the 1960s began to enter the retirement age and China gradually moved toward an aging society, however, at present, China is still in an important transition period of eliminating backward production capacity and upgrading its industrial structure. Labor shortage and aging problem are likely to hinder the development of China's economy and cross over the "middle-income trap", even may lead the country to get old before getting rich. In 2015, the Fifth Plenary Session of the 18th CPC Central Committee put forward the policy of "the full implementation of a couple can have two children" policy (i.e. the "universal two-child" policy), and it came into effect on January 1, 2016. Faced with the "universal two-child" policy, people began to think about such issues as "Whether or not give birth to two children" and "whether we have the ability to bring up two children". Then what are the factors that affect family decision-making? How does the family make the optimal fertility choice? How to implement "universal two-child" policy more smoothly? In this paper, through the establishment of overlapping generational household utility model, we finds that the economic cost, leisure time spent on childbearing and the household utility elasticity of consumption have a negative influence on family fertility choice; the level of father's wage, the utility elasticity of child-bearing and the children's income elasticity of human capital investment play a positive role in family fertility choice.

The remaining part of this paper is as follows, the second part is the literature review, the third part establishes the household utility model which contains the parents' salary level and the expected income of the children, the fourth part analyzes the influencing factors of the best fertility choice and the last part puts forward the related policy suggestions.

1. LITERATURE REVIEW

Scholars have conducted extensive theoretical discussions and empirical analyses of the optimal fertility choice. In the early theoretical research, Becker (1977) proposed

the theory of the household's need for children. He regarded children as durable consumption goods and can bring psychological satisfaction and spiritual benefits to parents, so child bearing can improve the utility of the parents. With the same total household income, parents allocate their household income between the child-bearing and purchasing of goods, and maximize their household utility. He believed that families in the economically underdeveloped areas raise to provide against old age, while the families having children in economically developed areas are more for mental benefits rather than for cash. He believes that the number of children is negatively correlated with the quality of the children, which has alternative relationship between them. The higher the mother's wage in household, the greater the opportunity cost of having children, so the mother's income and the number of children are negatively correlated.

Liebenstein (1981) proposed the cost-utility theory of a family's fertility behavior. He considered that the cost of child-bearing includes both direct costs and indirect costs. The direct cost is the expenditure on raising a child, and the indirect cost is the opportunity cost given up by mothers for having a child. The utility of giving birth to a child includes the economic income that children give back to their families as they grow up, and the patents' emotional satisfaction for raising children. When utility is greater than cost, families choose to have children. With the accumulation of social capital and the improvement of the social welfare, people's demand for raising their children to provide against old age will drop, this is the reason of the declining birth rate in developed countries. Since the 1990s, scholars have studied the optimal fertility choice by establishing a household utility model, such as Barro and Becker (1989), Boldrin and Jones (2002), Croix and Doepke (2003) and others.

In empirical studies, Boldrin et al. (2015) examined the relationship between fertility and social welfare, and found that the decline in fertility was related to the increase in government-provided old-age pensions. Shapiro and Tenikue (2017) found that the fall of the fertility rate in sub-Saharan Africa was due to increased female education and declined infant mortality. Bhat (2017) found the reduction of fertility in India is resulted from the rise of contraceptive knowledge level of illiterate women. Song et al. (2012) established the fertility decision-making model for Chinese rural households and conducted empirical analysis. The results show that the number of children born in the rural areas is determined by the land income and the cost of having children. Based on the survey of single child families who are eligible for selective child in Xuzhou City of China, Tan (2015) found that economic cost is the main factor influencing the childbearing in urban and rural areas, followed by the consideration of career development, the pressure on child education and the time spent on child-bearing. Based on

the survey data of Shandong Province of China, Zhang et al. (2016) found that the first child's sex and age, the parent's regional and subjective factors have a significant impact on the family's desire to have second child. Based on the data of birth survey in 12 cities in 6 provinces of China, Jing et al. (2016) found that the economic cost and care pressure affect the plan of giving birth to second child, woman living with her parent in-laws, having brothers and sisters, with the first child being girls tend to have second child.

Reviewing the recent literature, we found that most of the studies analyzed the factors influencing fertility decision-making based on the empirical analysis and few studies have been carried out by establishing a household utility model. This paper constructs a simple model of generational overlapping household utility model including the wage level of parents and the expected income of children. In results, the paper comes up with a balanced fertility level through maximizing the household utility and further analyzes the factors influencing fertility decision-making.

2. THE ESTABLISHMENT OF HOUSEHOLD UTILITY MODEL

According to Barro and Becker's (1989) set of household utility functions, the elasticity of household utility with respect to consumption is β and less than 1. The children as a kind of consumption goods or investment products, people raise children to provide against old age or hope their children will have a bright future. The higher the expected income of children the more satisfaction and utility are obtained by parents through childbirth. The transferring coefficient of the children's expected income Y_{t+1} transferred into the utility of parent is γ and less than 1. The parent's utility function U_t is shown in Formula (1), and C_t is the consumption of the parent.

$$\ln U_t = \beta \ln C_t + \gamma \ln Y_{t+1} \qquad (0 < \beta < 1, 0 < \gamma < 1). \quad (1)$$

Y_{t+1} is expressed by the Cobb-Douglas function, as shown in Formula (2). A stands for total factor productivity, the higher the total factor productivity, the more developed the society and the higher the parents' expectation on their children's income. k stands for a family's economic cost of having children, including expenditure on care, housing, healthcare, education, etc., n represents the number of children and not more than the national maximum number of childbirths per family, kn is the total expenditure of childbearing and also represents the human capital investment to children. The children's income elasticity of human capital investment is α and less than 1.

$$Y_{t+1} = A(kn)^\alpha \qquad (A > 0, 0 < \alpha < 1, n \le \bar{n}). \quad (2)$$

Family fertility and consumption should be constrained by the total family income, that is, the parent's

wage income and extra-wage income. The household consumption constraint is given by Formula (3), where the household consumption C_t equals the income of the parent minus the expenditure of childbearing. The model does not take household extra-wage income into consideration for the sake of simplicity. $\bar{t}$ stands for the work time of normal workforce, w_1 and w_2 respectively represent the wage levels of parents, t represents the time of childcare, which is the working time that parents give up for giving birth to a child. We assume that giving birth to children would reduce the working hours of the mother, and decrease her income.

$$C_t = w_1\bar{t} + w_2(\bar{t} - nt) - kn . \tag{3}$$

Taking Formulas (2), (3) into (1), yield the household utility Function (4).

$$\ln U_t = \beta\ln\left[w_1\bar{t} + w_2(\bar{t} - nt) - kn\right] + \gamma\ln A + \gamma\alpha\ln(kn) . \tag{4}$$

By maximizing the household utility, i.e. solving the equation $\partial\ln U_t / \partial n = 0$, the optimal fertility number n^* is obtained. The Formula (5) lists the n^*, we can see that the optimal choice of childbirth is jointly decided by the parents' wage level, the household utility elasticity of consumption, economic costs of childbirth and other factors.

$$n^* = \frac{\alpha\gamma\bar{t}(w_1 + w_2)}{(\alpha\gamma + \beta)(w_2 t + k)} . \tag{5}$$

3. THE OPTIMAL FERTILITY CHOICE

3.1 The Impact of Economic Costs on Optimal Fertility Choice

The economic cost of childbirth k has a negative effect on the optimal choice of childbirth, as shown in Formula (6). As the cost of childbirth increases, people's demand for children declines. The conclusion is consistent with Becker's theory of children's needs and the empirical results of study of Tan (2015). There is an alternative relationship between the number and the quality of children in a family. Families in more economically developed regions pay more attention to the quality of their children, they invest more on their children and they choose to have fewer children.

$$\frac{\partial n^*}{\partial k} = \frac{-\alpha\gamma\bar{t}(w_1 + w_2)}{(\alpha\gamma + \beta)(w_2 t + k)^2} < 0 . \tag{6}$$

3.2 The Impact of Father's Wage Level on the Optimal Fertility Choice

Under the constant labor supply, the father's raising salary level would contribute to the total household income which enables the family to raise more children. As shown in Formula (7), the increase of the father's income has a positive effect on the number of children. From this conclusion, we could see that the increase in the household extra wage income will also lead to an increase

in the number of children. As a result, wealthy families tend to have more children, and in China, where a family planning policy is implemented, the superstar's being punishment of having over-born children could be an example.

$$\frac{\partial n^*}{\partial w_1} = \frac{\alpha\gamma\bar{t}}{(\alpha\gamma + \beta)(w_2 t + k)} > 0 . \tag{7}$$

3.3 The Impact of Mother's Wage on the Optimal Fertility Choice

The impact of the mother's wage on the optimal fertility choice, as shown in Formula (8), which determined by both of the income effects and substitution effects. There is a positive income effect, because the increasing mother's income would contribute to the total family income, which enables families to have more children. Meanwhile, the increase in mother's income means the greater opportunity cost of giving up her work for having children, in this way, mothers' will of having children would declines which means resulting in negative substitution effect. When the income effect is greater than the substitution effect, the increase of the mother's income leads to the increase of the number of children. When the income effect is less than the substitution effect, the increase of the mother's income leads to the decrease of the number of children.

$$\frac{\partial n^*}{\partial w_2} = \frac{\alpha\gamma\bar{t}(k - w_1 t)}{(\alpha\gamma + \beta)(w_2 t + k)^2} . \tag{8}$$

As shown in Formula (8), when $k - w_1 t > 0$, $\frac{\partial n^*}{\partial w_2} > 0$, the mother's income has a positive effect on the number of children, that is, the income effect is greater than the substitution effect. When $k < w_1 t$, $\frac{\partial n^*}{\partial w_2} < 0$, increasing mother's income reduces the number of children. As for a family, the father's income level determines the impact of the mother's wage on the childbearing, when the father's income is relatively low, the raise of the mother's income increases the number of children. When the father's income is relatively high, the lower mother's income, they tend to have more children. This conclusion is a supplement to the existing theory, i.e. the increase of the mother's salary does not necessarily lead to a decrease in the number of children. The income effect and the substitution effect have a combined effect on a family's decision on childbirth.

3.4 The Influence of the Time of Childcare on Optimal Fertility Choice

As is shown in Formula (9), the optimal birth selection is negatively related to the time of childcare. The time spent on child care is negatively correlated to the number of children. This is the reason why wage-earners do not want to have more children, while rural families have more

leisure time to look after their children and they tend to have more children.

$$\frac{\partial n^*}{\partial t} = \frac{-\alpha\gamma\bar{t}w_2(w_1 + w_2)}{(\alpha\gamma + \beta)(w_2 t + k)^2} < 0 \ . \tag{9}$$

3.5 The Impact of Household Utility Elasticity of Consumption on the Optimal Fertility Choice

The household utility elasticity of consumption β measures the effect of changes in consumption level on household utility. The greater the β value, the higher the proportion of consumption in the household utility. As shown in Formula (10), the change of β has a negative effect on the optimal fertility choice. That is, as β increases, the consumption becomes more important to total household utility than to grow a child. Therefore, one of the reasons for the emergence of hedonic Dinks in society is the family's choice to allocate more income to current consumption rather than childbearing.

$$\frac{\partial n^*}{\partial \beta} = \frac{-\alpha\gamma\bar{t}(w_1 + w_2)}{(\alpha\gamma + \beta)^2(w_2 t + k)} < 0 \ . \tag{10}$$

3.6 The Impact of Family's Utility Elasticity of Childbearing on the Optimal Fertility Choice

The impact of the household utility elasticity of childbearing γ on optimal fertility choice is shown in Formula (11), the effect of γ has positive influence on the optimal number of births. The higher γ is, the family can obtain more utility from having children, and they tend to give birth to more children.

$$\frac{\partial n^*}{\partial \gamma} = \frac{\alpha\beta\bar{t}(w_1 + w_2)}{(\alpha\gamma + \beta)^2(w_2 t + k)} > 0 \ . \tag{11}$$

3.7 The Effect of the Income Elasticity of Human Capital Investment on the Optimal Fertility Choice

As shown in Formula (12), the children's income elasticity of human capital investment α has a positive effect on the optimal number of childbirth. The larger the value of α means the higher return on capital investment in labor, the higher the expected income of children and the higher level of patents' utility.

$$\frac{\partial n^*}{\partial \alpha} = \frac{\beta\gamma\bar{t}(w_1 + w_2)}{(\alpha\gamma + \beta)^2(w_2 t + k)} > 0 \ . \tag{12}$$

The economic costs, time spent on childcare and family utility elasticity of consumption are the negative influencing factors among the above mentioned factors that affect the optimal level of fertility. The wage level of father, the family's utility elasticity of childbirth and the income elasticity of human capital investment are the positive factors, the impact of mother's salary level is uncertain. The household utility elasticity of consumption, the family's utility elasticity of childbearing and the children's income elasticity of human capital investment has certain stickiness in the short term. Therefore, for increasing the number of children in the short term, we need to reduce the economic cost of having children, the parent's time of childcare and the father's income. At the same time, raising female income among the lower-income groups can also help increasing the number of children.

SUMMARY

With the gradual decline of demographic dividend in China today, the implementation of the "universal two child" policy can increase the total population of the community and in the future it will provide more labor force for the society, to increase the total social wealth and also reduce the burden of pension against aging. In fact, many families may have the desire to have two children, but according to the findings of this study, many factors will affect the decision-making of having two children. Therefore, combining these factors, in this paper suggests are put forward to promote the implementation of the "universal two child policy".

First, the government should increase its spending on the public security system to reduce the families' economic costs of having children. At present, China has adopted such measures as maternity insurance, free vaccination for children, exemption of tuition fees for compulsory education and student loans in higher education. These medical, insurance and education expenditures of government reduced the parents' burden of child bearing. The state can further improve its public security system, increase its assistance to low-income groups, explore new and more appropriate means of support, meanwhile, the government should increase its' supervision and put the relevant measures into practice.

Second, the government should improve laws and regulations to protect the rights and interests of women and children. By means of law, women should be given the right of birth option and maternity protection to avoid employment discrimination against women. At the same time, the government should strengthen their management on public services such as nurseries, kindergartens and schools to provide families with safe, convenient conditions to take care of their children, so as to reduce the parent's burden and eliminate their worries.

Third, the government should further improve the labor productivity of society and increase family income level. The government should speed up the upgrading of industrial structure and technological innovation so as to increase the labor remuneration and the household income, enhance the ability of families to have children. At the same time, the government should broaden family investment channels and improve family extra wage income which will effectively increase family's fertility level.

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