

Hierarchical Linear Model Analysis on the Factors Influencing the Fertility Desire of Childbearing-Aged People under the Background of Three-Child Policy

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Abstract: The survey of fertility desire is of great significance to the population prediction and the formulation of fertility policy. This paper uses Theory of Planned Behavior to determine the range of contributing factors and design an online questionnaire. It uses Hierarchical Linear Model to analyze the specific contributing factors of fertility desire of childbearing-aged people as well. The results show that under the background of the three-child policy, economic factors such as the cost of childcare and family income have a significant impact on the fertility desire of childbearing-aged people, followed by the peers' concept on birth and the pressure from elders. Young people pay more attention to the development of personal career, and the factor of fertility policy has little impact on the fertility desire of childbearing-aged people.

Keywords: Fertility desire, Three-child policy, Theory of Planned Behavior, Hierarchical Linear Model.

1. Introduction

In 2022, China's population began to experience negative growth, with the total fertility rate falling below 1.1. The effect of the overall two-child policy is not as expected, and the effect of the three-child policy has not been shown, and it hasn't reversed the downward trend of China's birth population. The effect of the birth accumulation has subsided, and it is urgent to liberalize and encourage childbearing.

Fertility desire has always been a subject of research in the field of demography and sociology, especially when the government attempts to improve or reduce the fertility level, and fertility desire is one of the important basis for formulating national public policies^[1]. Theory of Planned Behavior provides a logical idea for studying the relationship among individual fertility desire, fertility planning and fertility behavior. By studying the contributing factors of fertility desire and fertility behavior gap from the micro level, it can promote the theoretical interpretation of fertility intention and fertility behavior difference^[2]. Theory of Planned Behavior is a multilevel regression model, which can consider both the influence of individual-level and group-level factors on fertility desire. By performing a hierarchical modeling of the individual and district-level data, Hierarchical Linear Model can provide a more accurate and comprehensive analysis of the factors influencing fertility desire.

Through the study of relevant literature, it is found that many people use binary logistic regression to study the contributing factors of the fertility intention of childbearing-aged people, but the research results are different, which indicates that there is still much room for improvement in the fertility desire of childbearing-aged people. This study is based on the existing research conclusions, combined with the five elements of Theory of Planned Behavior of social psychology to select the independent variables of this project,

and used the HLM model for modeling, and deeply analyzed the contributing factors of fertility desire of childbearing-aged people through the combination of psychology and statistics. The results will provide a reference for the government to formulate more targeted policies and measures.

2. Research Methods

2.1. Data Source

Individual-level data in this study were obtained from an online questionnaire. The data of average cost of raising children aged 0-17 on the regional level is selected from the data from the 2022 China Birth Cost Report, and the proportion of consumption expenditure to total income, average academic year of education, urbanization rate and participation rate in maternity insurance are selected from China Statistical Yearbook 2022.

2.2. Variable Selection

This study examines the desired number of children in an online survey as the dependent variable. The individual-level independent variables include personal attributes (gender, age, education level, total annual family income, residential area type), perceptual controls (desired gender of children, personal career development, health condition, fertility policies, peers' fertility beliefs, parental pressure), and fertility motivations (end-of-life care, continuing of family lineage, increasing life enjoyment, social responsibility). In total, there are 15 variables across these three categories, and the descriptive statistics for each variable can be found in Table 1. The regional-level independent variables include five variables (average cost of raising children aged 0-17, proportion of consumption expenditure to total income, average academic years of education, urbanization rate, participation rate in maternity insurance), with specific descriptions provided in Table 2.

Table 1. Description Statistics of Individual-Level Independent Variables

Variable name	Variable definition and description	Average value	Standard error
Gender	1= male, and 2= female	1.47	0.72
Age	1=18-25 years old, 2=26-30 years old, 3=31-35 years old, 4=36-40 years old, 5=41 years and above	2.89	1.17
Education level	1= high school and below, 2= technical secondary school / junior college,3= Bachelor degree or above	2.37	1.06
Total annual family income	1 = less than 50,000 yuan, 2=50-100,000 yuan, 3=100,000-150,000 yuan, 4=150,000-200,000 yuan, 5 = more than 200,000 yuan	2.26	1.19
Residential area type	1= city, 2= county seat, and 3= rural area	1.97	0.98
Desired gender of children	1= boy, 2= girl, and 3= indifferent	2.01	1.03
Personal career development	5-point scale, 1 to 5 indicates increasing significance		
Health condition	5-point scale, 1 to 5 indicates increasing significance	3.23	1.25
Fertility policies	5-point scale, 1 to 5 indicates increasing significance	2.21	1.11
Peers' fertility beliefs	5-point scale, 1 to 5 indicates increasing significance	3.75	1.23
Parental pressure	5-point scale, 1 to 5 indicates increasing significance	3.63	1.05
End-of-life care	5-point scale, 1 to 5 indicates increasing significance	3.26	1.13
Continuation of family lineage	5-point scale, 1 to 5 indicates increasing significance	3.66	1.06
Increasing life enjoyment	5-point scale, 1 to 5 indicates increasing significance	3.97	1.15
Social responsibility	5-point scale, 1 to 5 indicates increasing significance	2.33	1.01

Table 2. Regional-level Variables and Their Description

variable name	variable declaration
Geographic classification	Central China, South China, Southwest China, Northwest China, North China, Northeast China , East China
Average cost of raising children aged 0-17	Data are selected from "2022 China Birth Cost Report"
Proportion of consumption expenditure to total income	Share of per capita expenditure in total total income
Average academic year of education	Population The total academic year of education / total population
Urbanization rate	Urban population at the end of the year / total population at the end of the year
Participation rate in maternity insurance	Number of people participating in maternity insurance at the end of the year / total number at the end of the year

2.3. Model Construction

In this study, HLM software was used to analyze the data and construct the HLM model, in which the individual level is the first variable and the regional level is the second variable. In order to accurately find out the contributing factors affecting the fertility desire of childbearing-aged people, the principle of gradual regression is adopted, the variables from individual level and regional level are gradually added, and the full model of individual level and regional level is constructed as follows:

Level 1: the individual level

$$Y = \beta_0 + \beta_1(Gender) + \beta_2(Age) + \beta_3(Educational\ level) + \beta_4(Total\ annual\ family\ income) + \beta_5(Residential\ area\ type) + \beta_6(Desired\ gender\ of\ children) + \beta_7(Persidential\ career\ development) + \beta_8(Health\ condition) + \beta_9(Fertility\ policy) + \beta_{10}(Peer\ fertility\ beliefs) + \beta_{11}(Parental\ perssure) + \beta_{12}(End - of - life\ care) + \beta_{13}(Continuation\ of\ family\ lineage) + \beta_{14}(Increasing\ life\ enjoyment) + \beta_{15}(Social\ responsibility) + \mu$$

In the above formula, Y represents the expected number of children desired by the respondents. β_0 is the random intercept, and $\beta_1, \beta_2, \beta_3, \dots, \beta_{15}$ are the regression coefficients. μ represents the random error term.

Level 2: at the regional level

$$\beta_0 = \gamma_{00} + \gamma_{01}(\text{Average cost of raising children aged 0 - 17}) + \gamma_{02}(\text{Proportion of consumption expenditure to total income}) + \gamma_{03}(\text{Average academic year of education}) + \gamma_{04}(\text{Urbanization rate}) + \gamma_{05}(\text{Participation rate in maternity insurance}) + \mu_0$$

In the above formula, $\gamma_1, \gamma_2, \dots, \gamma_5$ are the regression coefficients. μ_0 represents the random error term.

The null model analysis took the number of children expected of childbearing-aged people as the dependent variable. The model decomposed the differences of the number of expected children into regional differences and regional differences. Regional differences are caused by individual reasons, and regional differences are caused by the differences in different regions. The results are shown in Table 3.

Table 3. Null Model (Model 1)

stochastic effect	Standard error	Variance component
Interregional variation of the residuals	17.27	277.23
Regional intra-variance residuals	22.24	429.36

According to the analysis of HLM software, the cross-level correlation $\rho=0.39$, indicating that 39% of the total difference in the number of expected children in the childbearing age can be explained by region-level variables.

3. The Results of the Study

3.1. Effect of Individual-level Variables on Fertility Desire of Childbearing-aged People

At the individual level, the gender, age, education level,

total annual family income and residential area type were used for regression analysis (model 2) to observe the influence on the number of children expected to have (model 3), then the variables of perceptual controls (model 4) and fertility motivation (model 5) were gradually added. The analysis results are shown in Table 4.

Table 4. Empirical Analysis of HLM of Factors Affecting Fertility Desire in Childbearing Age

variable name	model 2		model 3		model 4		model 5	
	coefficient	standard error	coefficient	standard error	coefficient	standard error	coefficient	standard error
Sex	-0.17	2.31	0.06	3.24	0.09	2.17	0.07	1.23
Age	0.19**	4.37	0.12**	2.17	0.13**	2.39	0.09**	2.15
Education level	-0.13**	1.26	-0.11*	3.32	-0.08*	1.06	-0.09*	1.24
Total annual family income	0.21***	4.41	0.19***	1.00	0.20***	4.57	0.23***	4.61
Residential area type	0.12*	2.66	0.05*	1.08	0.09*	1.16	0.06*	1.28
Desired gender of children			-0.03	2.10	-0.05	2.31	-0.04	1.06
Personal career development			-0.08***	1.33	-0.19***	4.52	-0.19***	4.22
Health condition			0.10*	3.16	0.11*	3.21	0.13*	3.26
Fertility policy			-0.02	2.17	-0.04	1.03	-0.05	1.03
Peers' fertility beliefs			-0.11**	4.13	-0.15**	4.06	-0.18**	4.05
Parental pressure			0.12**	3.46	0.09**	2.35	0.15**	2.35
End-of-life care					0.06*	1.69	0.10*	1.70
Continuation of family lineage					0.05	1.25	0.08	1.25
Increasing life enjoyment					0.19**	4.63	0.21**	4.63
Social responsibility					0.08	2.31	0.10	2.26
Average cost of raising children aged 0-17							-0.04***	1.19
Proportion of consumption expenditure to total income							-9.71**	26.38
Average academic year of education							-0.09	1.37
Urbanization rate							-6.32	13.26
Participation rate in maternity insurance							13.23	21.40

Note: * indicates $p < 0.05$, ** $p < 0.01$, and *** $p < 0.001$

3.1.1. Impact of Personal Attributes on the Fertility Desire of Childbearing-aged People

The data of Model 2 show that: (1) Gender has no significant effect on the fertility desire of childbearing-aged people; (2) Education level has a significant negative influence on the fertility desire of childbearing-aged people, and the number of children is expected to decrease by 0.13 for each unit of education level; (3) The total annual family income has a significant positive prediction effect on the fertility desire of childbearing-aged people, and the number increases by 0.21.

3.1.2. Impact of Sensory Control Factors on the Fertility Desire of Childbearing-aged People

The data of model 3 shows that: (1) personal career development has a significant negative prediction effect on the fertility desire of childbearing-aged people. Individuals believe that the importance of personal career development decreases the number of expected children by 0.08, which indicate that the importance of individuals to the development of personal career will inhibit the fertility desire. (2) The gender of wanting to have children has no significant impact on the fertility desire of childbearing-aged people, which is different from the conclusions of previous studies. For example, Jin Yongai believes that in today's urban families, gender preference still exists and affects the fertility planning[3]. (3) The peers' fertility beliefs and parental

pressure have a significant impact on the fertility desire of childbearing-aged people, among which peers' fertility beliefs have a significant negative impact on the number of children expected to have, while the pressure of elders has a significant positive impact on the number of children expected to have. This shows that the young group has weak fertility desire, while the older group wants the young group to increase fertility. (4) The fertility policies have no significant impact on the fertility desire of childbearing-aged people.

3.1.3. Influence of Fertility Motivation on the Fertility Desire of Childbearing-aged People

The data of model 4 show that: (1) Increasing life enjoyment has a significant impact on childbearing-aged people, and the importance of increasing the number of expected children increases by 0.19. (2) Continuation of family lineage and social responsibility have no significant impact on the fertility desire of childbearing-aged people.

3.2. Impact of Regional-level Factors on the Fertility Desire of Childbearing-aged People

Model 5 data present: (1) The average cost of raising children aged 0-17 and the proportion of consumption expenditure to total income have a significant impact on the fertility desire of childbearing-aged people. Among them, The

average cost of raising children aged 0-17 has significant reverse prediction of the fertility desire of childbearing-aged people. For every 1 thousand yuan increase of children aged 0-17,000, the number of individual expected children decreased by 0.04. (2) The average academic year of education, urbanization rate and the participation rate in maternity insurance have no significant impact on the fertility desire of childbearing-aged people.

Based on the analysis above, there are a total of 9 variables that significantly influence the fertility intentions of the reproductive-age population. Among them, there are 7 variables at the individual level, namely age, educational level, and total annual family income in personal attributes; personal career development, peers' fertility beliefs, and parental pressure in perceptual controls; and increasing life enjoyment in fertility goals. At the regional level, there are variables including the average cost of raising children aged 0-17 and the proportion of consumption expenditure to total income.

4. Discussion and Suggestions

Among the individual factors that affect the fertility desire of childbearing-aged people, the annual family income and individual career development are more important. It shows that the main factor restricting the fertility desire of childbearing-aged people is economic factor, and the high economic cost of child care reduces the fertility desire of childbearing-aged people. Moreover, young people pay more attention to the development of their personal career, and they worry that having more children may affect the development of their personal career. Among the regional factors, the average parenting cost and consumer spending of children aged 0-17 are more significant. This shows that the cost of childcare and individual income and spending vary greatly among regions, and further confirms the influence of economic factors on the fertility desire of childbearing-aged people. In order to help solve the problem of low fertility rate and increasingly serious aging population in China, the following four suggestions are proposed.

First, the government should increase its financial input, and perfect fertility supporting services to reduce the cost of procreation and parenting education. The study shows that the main factors restricting the fertility of childbearing-aged people are economic factors, and reducing the cost of parenting and education may stimulate the fertility desire of some childbearing-aged people. We can explore the establishment of a comprehensive birth encouragement system from pregnancy health care to pregnancy and delivery to the age of 18 or the end of academic education, including pregnant health care subsidies, hospital delivery subsidies, childcare allowance, education allowance, family income tax deduction, and direct economic subsidies for low-income people who do not meet the individual income tax standards^[4].

Second, publicize and educate young people to enhance their sense of social responsibility. The data of this study show that social responsibility factors have a low impact on fertility desire of childbearing-aged people, but personal career development has a significant impact on fertility desire. It shows that young people pay more attention to the

development of their own career, take self-development as the center, and have a weak understanding of social responsibility. Therefore, publicity and education should be strengthened to help young people change their concept of marriage and childbearing, and enhance their sense of social responsibility and mission.

Third, improve the relevant contents and measures of the three-child policy and increase the publicity and promotion efforts. The survey shows that the factor of policy have little influence on childbearing-aged people, indicating that the current fertility policy does not fully stimulate the fertility desire of childbearing-aged people. To further increase the influence of the birth policy, we should not only continue to strengthen the effective measures such as service management and interest orientation, but also need to attach great importance to the publicity and advocacy and scientific and technological guidance, and create a good public opinion atmosphere^[5].

Fourth, the local birth policy should be further differentiated on the basis of the national policy according to the actual situation. Due to the big differences in fertility costs and residents' income and expenditure in different regions, it has a significant impact on the fertility desire of childbearing-aged people in different regions. Therefore, to reduce the impact of regional differences in support of encouraging fertility, different regions should implement appropriate policy subsidies according to the actual situation^[6].

Acknowledgment

This work is supported by 2022 National Undergraduate Innovation and Entrepreneurship Training Program, Project number: 202210378202.

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