

Determinants of Birth Rate under China's "Two-Child Policy"

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Abstract: In this study, the factors to affect the birth rate in China are analyzed at the provincial level. The panel data were collected from 2016 to 2020 under the "two-child policy". Based on the random-effects model, disposable income of households, elderly dependency ratio, and public expenditure for medical and health care, family planning have a negative relationship with the birth rate. On the contrary, consumption expenditure of households, Gross Regional Product, and children dependency ratio have a positive correlation with the birth rate. Therefore, this paper suggests that the adjustment in fertility policy has quite a limited effect on the birth rate. Improvement of people's living standards, reduction of the cost and pressure on childbearing, and protection of women's reproductive rights are more effective ways to raise fertility levels.

Keywords: birth rate, fertility policy, income and expenditure, cost of the childbearing, random-effects model

1. Introduction

According to the report of the United Nations, the world's population has a great possibility of reaching 8.5 billion in 2030 and it may reach 9.7 billion in 2050.[1] The issue of the population raises concerns of policymakers to search for a way to balance fertility, human rights, and productivity. China, the country which has the largest population in the world with the most controversial population policies, currently also faces the issues of a society with a high population, low birth rate, and an aging population.

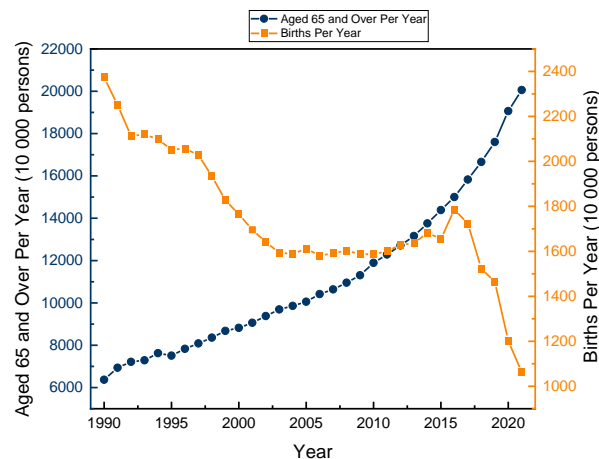


Figure 1: Number of Published Births and Aged 65 and Over Per Year (1990-2021)

Referring to the report of China's seventh national population census, the total fertility rate was 1.3 in 2020, which was lower than the replacement level (2.1) and became an urgent issue to be solved.[2] The number of published births in 2020 was only about 12 million, which is the second lowest since 1949. The problem of fertility also influences the aging population. Figure 1 displays that published births per year in China generally kept a downtrend from 1990 to 2021. Furthermore, the published births steeply declined from 2015 to 2021 after the Chinese government eased the "One-child policy". China's published births continuously fell year by year while the population aged 65 and above stably

rose with the years. In 2021, China's population aged 65 and above reached enormously 200.56 million. By contrast, the total population of the UK was around 66.49 million in 2021. The slowdown in births caused the reduction of demand for consumption, especially the consumption for childcare, education, and real estate. Deepened aging population caused a financial burden on families and a shortage of labor force. The serious situation pushed the Chinese government to enact pro-natalist policies.

Resource cited from China Statistical Yearbook, Annual Statistical communique of the People's Republic of China National Economic and Social Development.

Under China's pro-natalist policy, what factors determine the change in birth rates? How should the change in China's pro-natalist policy impact future population growth? It is a crucial question to ask. This paper is aimed to analyze the determinants of birth rates under the "Two-Child" policy. It is a significant topic that will not only decide how much financial expenditures spend and how the employment and educational conditions will be changed, but it also will impact the Chinese economic development and the improvement of human rights.

2. Methods

2.1. Data Source and Study Population

The data were sourced from the Chinese statistical yearbook and China Labour Statistical Yearbook from 2017 to 2021. The panel data were collected from 2016 to 2020 under the "Two-child policy". The data included the eastern region with 10 provinces, central region with 6 provinces, western region with 12 provinces, and northeastern region with 3 provinces on topics related to the population by sex ratio, birth rate, employment, education, endowment insurance, the income of households, maternity insurance, expenditure of households, CPI, GRP, dependency ratio of population and public budget expenditure.

The dependent variable "birth rate" refers to the annual birth rate based on the estimation of the annual national sample survey on population changes, measured by the number of births per year divided by the total population per year. To express the percentage change in the dependent variable caused by a one-unit change in the independent variables, the semi-log functional form is used. In this model, "ln(BR)" adopted to describe the dependent variable. 12 independent variables are investigated and labeled as "SR", "EF", "BEI", "DIH", "BMI", "CEH", "CPI", "GRP", "ODR", "FE", "EMF" and "EDR".

"SR" represents the variable "Sex Ratio", which is calculated by the number of boys born to every 100 girls at year-end. "EF" represents the variable "Educational Attainment of Female Employed Persons (College or Above)". It is the proportion of female employed persons educational degree is college or above. "BEI" represents the variable "Balance of Basic Endowment Insurance for Urban and Rural Residents at Year-end". It is measured at 1,000 million yuan. "DIH" represents the variable "Per Capita Disposable Income of Households", and "CEH" represents the variable "Per Capita Consumption Expenditure of Households". Two variables are measured by 1,000 yuan. "BMI" represents the variable "Beneficiaries of Maternity Insurance at Year-end". It is measured by 100,000 person-times. "CPI" represents the variable "Regional Consumer Price Indices". The base year is the preceding year and reflected the relationship between the change in price and fertility. "GRP" represents the variable "Gross Regional Product". It is measured at 100,000 million yuan. "EDR" represents the variable "Elderly Dependency Ratio". It is defined as the number of individuals aged 65 and over divided by the population ages 15-64. "CDR" represents the variable "Children Dependency Ratio". It is defined as the number of individuals aged 0-15 divided by the population ages 15-64. "FE" represents the variable "Female Employment in Urban Non-private Units". It is measured by 10 000 persons. "EMF" represents the variable "Public Expenditure for Medical and Health Care, Family Planning". It is measured at 1,000 million yuan.

2.2. Method of Data Analysis

Data Processing was carried out by online statistical software SPSSAU (Statistical Product and Service Software Automatically, <https://spssau.com/>) (Beijing Qingsi Technology Ltd.) To avoid spurious regression and test the robustness of the model, the ADF test is adopted. One improved method of the unit root test is the ADF test, which is commonly used as a tool to test the stationarity of economic data.[3] Based on the result of SPSSAU, for all variables (first-order difference), the p values

are lower than 0.01 in the ADF test proving the stationary characteristics under this panel data set.

There are three models generally used in panel data: the pooled model, the fixed-effect model, and the random-effects model. F test, BP test (Breusch–Pagan test), and Hausman test are usually applied to select correct models. According to Table 1, the F-test shows significance at the 5% level ($p < 0.05$) implying that the fixed-effect model is better than the pooled model. BP-test shows significance at the 5% level ($p < 0.05$), implying that the random-effects model is more suitable than the pooled model. The Hausman test did not present significance ($p > 0.05$), implying that the random-effects model is fitter than the fixed-effect model. According to the above tests, the random-effects model is used in the paper.

Table 1: Result of F test, BP test, and Hausman test.

| Summary of Test Results (n=155) | | |
|---------------------------------|-------------------------|---------|
| Test | F value or χ^2 | P value |
| F test | F (30,112) = 14.738 | <0.001 |
| BP test | $\chi^2(1) = 53.327$ | <0.001 |
| Hausman test | $\chi^2(12) = -101.810$ | 1.000 |

3. Results

Panel data of 31 provinces from 2016 to 2020 were included in the study. According to the statistical analysis (Table 2), independent variables "SR", "EF", "BEI", "BMI", "CPI" and "FE" did not show significance ($p > 0.05$), thus indicating that those variables do not have a directly relationship on the dependent variable "ln(BR)" in this random-effects model. For independent variables "DIH", "EDR" and "EMF", there were significance at 0.01 level and the regression coefficient values were lesser than 0, indicating that variables "DIH", "EDR" and "EMF" have significant negative effects on "ln(BR)". For independent variables "CEH", it showed a significance at 0.05 level and the regression coefficient value was positive, indicating that variables "CEH" has a significant positive effect on "ln(BR)". For independent variables "GRP" and "CDR", it shows significance at 0.01 level and the regression coefficient value is 0.008 and 0.019, indicating that CDR will have a significant positive influence relationship on "ln(BR)".

Table 2: Result of Random-effects Model.

| Variable | Coef | Std. Err | t | p | 95% CI |
|----------|--------|----------|--------|----------|-----------------|
| Constant | -4.970 | 2.156 | -2.306 | 0.023* | -9.196 ~ -0.745 |
| SR | -0.003 | 0.004 | -0.698 | 0.486 | -0.010 ~ 0.005 |
| EF | -0.004 | 0.005 | -0.794 | 0.429 | -0.014 ~ 0.006 |
| BEI | -0.003 | 0.002 | -1.839 | 0.068 | -0.007 ~ 0.000 |
| DIH | -0.023 | 0.008 | -3.007 | 0.003** | -0.038 ~ -0.008 |
| BMI | -0.001 | 0.010 | -0.124 | 0.902 | -0.021 ~ 0.018 |
| CEH | 0.025 | 0.013 | 1.995 | 0.048* | 0.000 ~ 0.050 |
| CPI | 0.010 | 0.021 | 0.460 | 0.646 | -0.032 ~ 0.051 |
| GRP | 0.008 | 0.003 | 2.627 | 0.010** | 0.002 ~ 0.015 |
| EDR | -0.031 | 0.007 | -4.531 | <0.001** | -0.045 ~ -0.018 |
| FE | 0.001 | 0.000 | 1.605 | 0.111 | -0.000 ~ 0.001 |
| EMF | -0.006 | 0.002 | -3.358 | 0.001** | -0.010 ~ -0.003 |
| CDR | 0.019 | 0.005 | 3.922 | <0.001** | 0.009 ~ 0.028 |

Note: $\chi^2(12) = 213.919$, $p < 0.001$; $R^2 = 0.475$, $R^2(\text{within}) = 0.653$; * $p < 0.05$, ** $p < 0.01$

In conclusion, among 12 independent variables, 6 variables have a significant impact on the change in the birth rate. Regarding the variable "DIH" or "Per Capita Disposable Income of Households", the result proves that the birth rate decreases by 0.023% for every 1,000 yuan increase in household disposable income per capita. Regarding the variable "EDR" or "Elderly Dependency Ratio", one unit of increase in elderly dependency ratio causes a 0.031% decrease in the birth rate. Regarding the variable "EMF" or "Public Expenditure for Medical and Health Care, Family Planning", every 1,000 million yuan increase in expenditure causes a 0.006% decrease in the birth rate. Regarding the variable "CEH" or "Per Capita Consumption Expenditure of Households", the birth rate increases 0.025% for every 1,000 yuan increase in consumption expenditure of households per capita. Regarding variable "GRP" or "Gross Regional Product", every 100,000 million yuan increase in Gross Regional Product causes a 0.008% increase in the birth rate. Regarding variable "CDR" or "Children Dependency Ratio",

one unit of increase in children's dependency ratio causes a 0.019% increase in the birth rate.

4. Discussion

By analysis of the random-effects model with panel data of 31 provinces from 2016 to 2020, economic factors including the disposable income of households, public expenditure for medical and health care, family planning, Gross Regional Product, consumption expenditure of households, and social factors including elderly dependency ratio and children dependency ratio are significantly associated with the birth rate.

Remarkably, public expenditure in the field of medical and health care, and family planning has a distinctly negative relationship with the birth rate. The more governmental policies spend on medical and health care, and family planning, the lower the birth rate will be. The reasons that public expenditure on medical and health care and family planning discourages the intention of childbearing are, firstly, outdated perspectives and systems still play essential roles. One of the main spending in public expenditure--family planning mainly included three projects: the incentive support for the rural part under the "One-child policy", special support for households qualified in the "One-child policy", subsidy of "fewer births, more wealth" project in the western region. Those projects offered incentives to households that should be benefited from the "One-child policy". Meanwhile, there are some misconceptions relating to fertility. Some administrators view humans as the "tool" of development. Many policymakers consider low birth rates and an aging society as the root cause of various economic and social problems. Scholars even proposed the idea of charging a tax to DINK (Dual Income, No Kids) families and limiting the number of divorce appointments.[4]

Secondly, public expenditure may be helpful to lessen the direct cost of childbearing but not having benefits to reduce the opportunity cost of childbearing. When a family considers childbearing, not only need the direct costs to be accounted for, but they also need to worry about some indirect costs. Government spending may improve the financial stress of couples when they decide to have children, but it is often unable to help with non-financial issues such as the time and energy to invest in caring for, educating, and raising children.

Meanwhile, the result shows the inverse correlation between the disposable income of households and birth rate while there is a positive relationship between consumption expenditure of households. The negative relationship between income and fertility is commonly seen and it usually is referred to as a demographic-economic paradox.[5] The theories of prospect theory and risk aversion can be reasons to explain the different influences of income and expenditure on the birth rate. According to prospect theory, compared with the reference point, individuals are risk aversion with payoffs of gains and risk lovers with payoffs of losses.[6] Risk aversion is a behavioral phenomenon that the unwillingness under uncertain prospects even when they may have expected gains.[7] In other words, If households face choices with certain gains, they frequently choose a sure outcome with a lower value than an unsure outcome with a higher expected value, in effect paying a premium to avoid uncertainty. When couples decide if they want to have children, except for the benefits from preferential policies and reciprocation of children, they also need to take the costs and risks into consideration. The families with high income have more certain and promising present conditions and they need to bear higher opportunity costs if they focus on childbearing rather than their continued career. The families with high consumption expenditure face more spending in the present condition, based on the prospect theory, they tend to consume and invest more in children. In other words, they are risk lovers in the present time. Especially, the Chinese have a traditional culture of "raising a child is an insurance for old age". When couples have much consumption expenditure now, they are more likely to invest in children to secure their old age.

Undoubtedly, economic development is another crucial factor to consider. The research of Western Europe also found that the positive association of GDP per capita with TFR indeed existed.[8] The positive relationship between GRP and birth rate indicates that when people face better economic prospects and have confidence for financial stability in their future life and work, they are more likely to have children.

Lastly, dependency ratios including the elderly dependency ratio and children dependency ratio also have a great influence on the birth rate. The greater the elderly dependency ratio is, the greater the pressure of taking care of elders in the family is. After the "one-child policy" over the past half century, most couples in China need to take care of four elders alone without the help of biological siblings. Therefore, once a family needs to spend a lot of energy, time, and money to take care of the elderly in

the family, it is possible to postpone the arrangement of childbearing. On the contrary, because of the current incentive childbearing policies, once couples have a child, they prefer to have two or three children. On the one hand, they want the child to have a companion while growing up. On the other hand, they can enjoy more benefits from the pro-natalist policy.

5. Conclusion

This paper is aimed to identify the determinants of the birth rate under China's second-child policy. With the analysis of panel data from 31 provinces between 2016 and 2020, this study shows that the consumption expenditure of households, Gross Regional Product, and children dependency ratio have a positive relationship with the birth rate. On the contrary, disposable income of households, elderly dependency ratio and public expenditure for medical and health care, family planning have a negative relationship with the birth rate. Therefore, the finding is instructive to improve China's "Three-child policy" and increase the fertility level. Moreover, this study indicates that improvement of people's economic standards, reduction of the cost and pressure on childbearing, and protection of women's reproductive rights are more effective ways to raise fertility levels rather than compulsory policy tools and the massive amount of public spending.

From the rule of change on population, the adjustment of fertility policy is not a panacea to influence demographic change. Some policymakers believe that once the policy is adjusted, people's fertility behavior will change, and the fertility level will immediately have a substantial increase, which is unrealistic. From the experience of countries around the world, whether it is a policy to restrict fertility or a policy to encourage fertility, the effect is quite limited.

The core of development should be human-oriented development. People should not be viewed as the mean of economic development but as the aim of development. Therefore, having children or not should be treated as a process of human development. In this process, society and government should create an environment that responds to people's desire to have children, rather than forcing people to have more or fewer children. At present, the most important thing is to create a fertility-friendly social environment, the intention of fertility can be not forced. Only by creating a good environment and conditions conducive to childbearing, people will have the desire for children, and then will the fertility level rebound, and the aging process may be slowed down. Those who expect to raise the birth rate through fertility policy are unrealistic because fertility behavior is a family decision and an individual decision, which cannot be completely influenced by external forces.

The high cost of childbearing is an important social issue to face. Childbirth is not only considered with financial costs but also opportunity costs. There is also a serious shortage of social services for childcare services. Even if couples have money, they may not have enough time to take care of children, and in some cases, couples may not be able to get access to enough healthcare and childcare services. The high costs of childcare services and the serious shortage of supply are prominent problems, which means that the support for childbearing is not sufficient. Public kindergartens are inaccessible and private kindergartens are too expensive, making many families who want to have children hesitant to do so. The government may not always be able to provide completely free public services, but it will be much more helpful if more affordable childcare facilities are established. Meanwhile, families with more children need more housing space, which means that issues such as high housing prices also need to be addressed. In addition, time costs of childbearing, such as maternity leave and other complementary policies, should also be mutual complementation of the three-child policy. Simply emphasizing raising the fertility level without the enhancement of complementary services is unlikely to be effective. If supportive policies for childbearing are put in place and couples have stable incomes and jobs in the present and future, they may eventually choose to have more children.

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