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Revista de cercetare și intervenție socială

ISSN: 1583-3410 (print), ISSN: 1584-5397 (electronic)
Selected by coverage in Social Sciences Citation Index, ISI databases

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Revista de cercetare și intervenție socială, 2016, vol. 52, pp. 105-129

The online version of this article can be found at:
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Published by:
Expert Projects Publishing House

On behalf of:
„Alexandru Ioan Cuza" University,
Department of Sociology and Social Work
and
Holt Romania Foundation
REVISTA DE CERCETARE SI INTERVENTIE SOCIALA
is indexed by ISI Thomson Reuters - Social Sciences Citation Index
(Sociology and Social Work Domains)

Effects of the "One-Child" Policy and the Number of Children in Families on the Mental Health of Children in China

Minjie FAN[1]

Abstract

For over three decades (1979 to 2015), China has comprehensively implemented the "one-child" policy, consequently the number of "one-child" families has increased. Due to being spoiled by their parents and the lack of companionship from siblings, the "one-child" policy has exerted adverse effects on the mental health development of only children. Using the survey data of the Rural–Urban Migration in China from 2008 to 2009, self-esteem, mental stress, and depression were employed in the study as indicators to measure mental health. An empirical analysis was conducted to determine the influence of the "one-child" policy on the mental health of the first generation of only children. Results demonstrate that compared with non-only children, only children born under the "one-child" policy are inclined to avoid difficulties and problems. In addition, they have low confidence, suffer from mental stress, exhibit a high depression trend, and have low happiness and sense of security. However, after further controlling the quantity of children in each family, we find that under conditions with limited resources, the case that larger families are better than one-child families is not true. As the number of sibling increases, the mental health indicators of children initially increase and then decline. This trend shows that having only one child or too many children in the family can both adversely affect the improvement of population quality. The results obtained in the study are beneficial for promoting the mental quality of the population, improving the quality of life, significantly optimizing the family structure.

Keywords: one-child policy, only children, mental health, population quality, social development.

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Introduction

The family planning policy of China has always been a popular topic related to social reform and has been the subject of debate in recent years. Among these policies, the "one-child" policy has received the most attention. Since 1979, the "one-child" policy has been strictly implemented to control the growth of population in China. This policy has fundamentally changed the family structure and the population structure in China, which is unprecedented event in both Chinese and world history. The implementation of the "one-child" policy has effectively inhibited the increase of the population in China; however, it has also led to a significant decrease in the fertility rate. According to the 6th National Census data, the total fertility rate in China is only approximately 1.3% in recent years, which is considerably lower than the generation replacement rate of 2.2%; hence, China has dropped into the "low fertility trap" (Jin, 2014). The most direct social expressions of this situation are the decrease in the number of children in each family and the abrupt increase in the proportion of families with only one child.

Given the special background and environment during their growth, only children do not only gain more physical satisfaction than non-only children, they also receive more mental and spiritual influences because of the special focus that their family and the society bestow upon them. However, only children also bear all the expectations of their parents. Being spoiled by their parents and the extremely high expectations of their parents are two main factors that induce the fragile mentality of only children. When they grow up, only children will experience tremendous pressure both at work and in daily life. To date, the social security system in China has not yet improved. Only children will be a part of the "inverted pyramid" family structure of "4+2+1" after they get married, that is, the husband and the wife, who are both only children, have to support four parents and raise one child. Under such circumstance, after the parents grow old, the only child will be left with the task of caring for his/her parents. Such children face tremendous pressure even in the spiritual and financial aspects of his/her aged parents' life. How can the problem of only children caring for his/her aged parents be solved? How can they nurture their own children under such situation? In a society where adults occupy the upper layer and children occupy the lower layer, the latter have to undergo extraordinary mental pressure. This phenomenon generally exists in only-children families, which suggests that China suffers from an imbalanced population structure and a decline in population quality to a certain extent.

Since 2008, the national family planning policy has begun to relax the restrictions gradually. A husband and a wife who are both only children can now have a second child. Moreover, if the husband or the wife is an only child and the wife gives birth to only one child during her first delivery, then they can have another

child. The comprehensive implementation of the "two-children" policy has just been promulgated. This practical action suggests that the nation has identified the need to adjust its population policy. The average age of the first generation of only children is currently 36 years old. This group constitutes the backbone of China's social and economic development, and their mental health status determines the increase in the health of the nation's human capital, which influences the supply-and-demand equilibrium of the labour market. The mental health is not only concerned with personal income and family operation, but also directly influences macroeconomic development and economic growth. In the aspect of population quality and beginning with the status of mental health, questions such as whether "fewer births" equate to "better birth" and whether a "quality–quantity trade-off" exists should be answered (Becker & Tomes, 1976). In this work, we intend to discuss the effects of the implementation of the "one-child" policy through an empirical study.

Literature Review

Research on the influence of the number of children in a family on the mental health of children has started at the beginning of the 20th century. The implementation of the "one-child" policy in China has further stimulated extensive discussions on this issue among domestic and foreign scholars.

At the beginning, western scholars have determined that only children tend to be self-centered, anxious, impulsive, and have poor adaptive ability (Blake, 1981). Jiao, Ji & Jing (1986) conducted a research on the "one-child" policy in China and compared samples with different genders, ages (from 4-10 years old), and census registers. Their results suggested that only children exhibited poor teamwork/collaboration and behavior control capabilities, were selfish, and easily frustrated. Other scholars also applied data from China and determined that the parents of only children regarded their child as "the apple of their eyes" and ensured that their child would experience maximum satisfaction with regard to the basic necessities in life. They would adopt a *Laissez-faire* attitude toward their only child and would demonstrate excessive affection and overprotection; consequently, only children would tend to be selfish and weak (Short, Zhai, Xu & Yang, 2001). Cameron, Erkal, Gangadharan & Meng(2013) applied the method of experimental economics to verify this conclusion; they determined that only children lacked a sense of security and showed a low level of trust toward others. Trent & Spitze (2011) used adults as samples to conduct their research; they found that compared with non-only children, only children had relatively poor social acceptability. Meanwhile, for samples who grew up away from their parents, the difference tended to be more significant.

However, other scholars have obtained the opposite conclusion. Yang, Ollendick, Dong, Xia & Lin (1995) compared children in regions where the "one-child" policy was not implemented with children in regions where the "one-child" policy was implemented. They determined that among the children in areas where the "one-child" policy was implemented during their birth, non-only children were more inclined to be anxious and terrified than only children. Non-only children born under such circumstance were more likely to suffer from social discrimination and considered "bad children". By contrast, only children were regarded as "good children". Such situation would lead to the poor psychological adjustment ability of non-only children and would make them highly anxious, depressed, and hostile. For children born when the "one-child" policy had not been implemented, no obvious difference existed between non-only children and only children. Some scholars in China also used college students as research samples and obtained the same conclusions. Zhang, Yu, Zhao, Li & Xiao (2007) used the Symptom Checklist-90-R and the Sixteen Personality Factor Questionnaire to conduct a survey on 427 college students; and discovered that the mental health of college students who were only children were better than that of not-only children. She & Song (2011) applied the China College Student Mental Health Scale to compare the mental health of only children and non-only children among urban college students. Their results suggested that among urban college students, significant differences were observed between only children and non-only children in terms of anxiety, depression, social withdrawal, social attack, paranoia, obsessive–compulsive disorder, dependence, and psychotic tendencies. Among urban college students, the mental health of only children was better than that of non-only children. Silles (2010) applied panel data to conduct an empirical study on young people aged 7, 11, and 16 years. The results suggested that the number of siblings exhibited a reverse causality with the psychological evaluation score and behavioral development of the samples. Liu, Lin & Chen (2010) conducted an investigation on teenagers in three middle schools in the suburban regions of the Fujian Province and discovered that only children were superior to non-only children in admission to colleges and universities as well as in social integration ability. In addition, resource dilution theory was applied to interpret the results. Yucel (2013) suggested that the number of children had no significant influence on the personality characteristics of the samples (including problem internalization, self-awareness, and view control). However, when the number of siblings surpassed four, the personality characteristics of non-only children were obviously poorer than those of only children.

According to other studies, no significant difference exists between only children and non-only children in terms of mental health status. Poston & Falbo (1990) applied data from urban and rural children in grades one to five in China and obtained similar conclusions. However, they found that compared with that of their peers, the learning ability of only children was higher. In their subsequent

research, Falbo & Poston (1993) applied data from 4000 children from grades three to six in four provinces in China to verify their conclusion. Hasnain & Adlakha (2012) applied data from India and found that no significant difference existed between only children and non-only children in terms of self-respect and happiness; however, the social maturity of only children was higher. The combination of social maturity and self-esteem would improve the happiness of these children. Chen & Liu (2014) conducted a grouping study on 10,000 teenagers according to the number of children in the family and obtained the conclusion that no significant difference existed between only children and non-only children in terms of mental stress, sensitivity, and problem behavior. Downey, Condron & Yucel (2015) used data from a large sample of American teenagers and found that the social interaction and integration abilities of only children were lower than those of non-only children in kindergartens and primary schools. However, such difference gradually disappeared during adolescence (Bobbitt-Zeher & Downey, 2013).

Some scholars have investigated the relations between children and their family. Buist, Deković & Prinzie (2013) conducted meta-analysis to study the differential treatment of parents toward their children, the relationship among children in a family, and the mental health of children. Their results indicated that the differential treatment of parents would be unfavorable to the mental health development of children. The relationship among children in a family presented a positive correlation with the mental health of children. Buist & Vermande (2014) conducted research on 1670 children in the Netherlands with an average age of 11.4 years. They classified the relationship among children as good, medium, and poor, and discovered that when the relationship among children was good, the aggressiveness of children would be low and the social competitive power of children would be strong. Whiteman, Solmeyer & McHale (2015) conducted a study on African-American families and obtained similar conclusions. In addition, a good relationship among children might also reduce depression and dangerous behaviour as well as enhance the social adaptiveness of children (Solmeyer, McHale & Crouter, 2014).

By analyzing the current literature, the following limitations were identified. First, the objects of study used both at home and abroad are teenagers and children. The long-term influence of the implementation of the "one-child" policy on the mental health of adults remains to be proven. Second, the area covered by the samples in domestic research is relatively limited and does not exhibit national representativeness. Third, domestic studies are mainly qualitative analysis. Cause–effect analyses implemented via measurement models remain scarce. In the present study, microdata that cover a national scope are utilized and a measurement model is applied using the first-generation of only children as the main objects of research. An empirical analysis is conducted to determine the long-term influence of the "one-child" policy on the mental health of only children, and thus, obtain

more reliable conclusions for decision-making. The remainder of this paper is organized as follows. The models and data used in the study are introduced in Section 3. The results of the empirical analysis are reported in Section 4. In Section 5, the reason for the results is further analyzed. Section 6 concludes the study.

Data, Variables, and Methods

Data and Sample Selection

The data used in the study were from the Rural–Urban Migration in China (RUMIC) (2008 to 2009), which were typically gathered by the Australian National University, the Beijing Normal University, and the Institute for the Study of Labor. RUMIC data covered nine provinces in China (Anhui, Zhejiang, Guangdong, Hebei, Henan, Hubei, Jiangsu, Sichuan, and Chongqing). Three investigations were conducted in 2008, 2009, and 2010. At present, the openly acquired data included survey data from 2008 to 2009. The database was composed of three parts: Urban Household Survey Data (UHS), Migrant Household Survey Data (MHS), and Rural Household Survey Data (RHS). Considering the objectives of this research, UHS, which included 5000 families in 19 cities of 9 provinces in the eastern, central, and western regions of China, were used. The investigation covered individual demographic characters, personalities, spiritual condition, relationship with family, population scale, population relationship, and household income and expenditures, among others.

The samples chosen for the study were adults born between 1979 and 1984. Given that the approach of the "one-child" policy was not strictly encompassing, the differences between urban and rural regions, as well as between the Han ethnic group and ethnic minorities, in terms of implementation degree were considerable. Hence, to guarantee the consistency and accuracy of the results, the objects of this study were members of the Han ethnic group with registered permanent urban residence. The policy was implemented nationwide after 1979. The researcher considered that period as the critical point, and thus, included samples during the first five years after the policy was implemented (1975–1979), as well as the samples born five years after the implementation of the policy (1980–1984). A time span of ten years was selected, which could effectively avoid the unapparent effects of the policy resulting from the extremely short implementation duration during the distinction process, as well as to prevent the estimated results from deviating because of an extremely long time span.

Setting Variables

Dependent Variables. The researcher grouped mental health indicators into three categories: self-affirmation, mental stress and depression, and other indicators. Self-affirmation indicators mainly include lack of self-confidence (if the answer is yes, then the assignment is 1; otherwise, the assignment is 0), feeling that they are worthless (if the answer is yes, then the assignment is 1; otherwise, the assignment is 0), and avoiding difficulties and problems (if the answer is yes, then the assignment is 1; otherwise, the assignment is 0). Mental stress and depression indicators mainly include the degree of focusing energy (if they think they can focus on the things that they are engaged in, then the assignment is 1; otherwise, the assignment is 0), the degree of mental stress (if they are always thinking, then they exhibit mental stress, and the assignment is 1; otherwise, the assignment is 0), and the degree of depression (if they are always thinking, then they are depressed, and the assignment is 1; otherwise, the assignment is 0). Other indicators mainly include the degree of happiness of the samples (if they think their life is happy, then the assignment is 1; otherwise, the assignment is 0), the degree of trust toward others (if they trust most people, then the assignment is 1; otherwise, the assignment is 0), and the degree of risk taking (if they prefer to take risks, then the assignment is 1; otherwise, the assignment is 0).

Independent Variables. Our control variables mainly include gender (if they are males, then the assignment is 1; otherwise, the assignment is 0), educational level (which includes five dimensions: primary schools and below, junior high schools, senior high schools, colleges and universities, and masters), job categories (which include four dimensions: formal workers, temporary workers, other workers, and jobless), marital status (which includes four dimensions: married, divorced or widowed, living together, and single), and family monthly income per capita, among others. The difference of the selected samples in terms of age was small; thus, the age variable was no longer controlled. By contrast, the fixed effects of years and regions were controlled. The mental health indicators of only children and non-only children were compared. An empirical analysis was conducted on the mental health of the interviewees with different numbers of siblings to determine whether having more siblings would be better.

Analytical Method

The models adopted in this study included the bivariate probit model and the probit model.

Bivariate Probit Model. This model would be applied for analysis when discussing the differences between only children and non-only children in terms of mental health status. In the probit model, if an endogenous binary variable exists, then the bivariate probit model can be used to perform a consistent estimation of

the parameter. In the bivariate probit model, a dependent variable in the probit equation appears in another probit equation; hence, this model is also called the recursive bivariate probit model.

The setting of the model is as follows:

$$Y^* = X_1\beta_1 + \gamma * S + \varepsilon_1 \quad (1)$$

$$S^* = X_2\beta_2 + \alpha * D + \varepsilon_2 \quad (2)$$

$$\begin{pmatrix} \varepsilon_1 \\ \varepsilon_2 \end{pmatrix} \Big| X_1, X_2 \sim N\left[\begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} 1 & \rho \\ \rho & 1 \end{pmatrix}\right] \quad (3)$$

Among which, Y^* is the explained variable, which includes self-affirmation, mental stress and depression, and other indicators.

If $S^* > 0$, then $S = 1$; otherwise, $S = 0$. In addition, ε_1 and ε_2 comply with binary joint normal distribution. The correlation coefficient is $Corr(\varepsilon_1, \varepsilon_2) = \rho$. Parameter ρ signifies the correlation between *S* and *Y*. If the relevant parameter ρ is statistically significant, then *S* is suggested to be endogenous; otherwise, the bivariate probit model is equivalent to estimating two probit equations. Under a condition with large samples, the estimated results remain consistent.

Bivariate *S* signifies whether the interviewees are only children. In Equation (1), γ denotes the differences between only children and non-only children in terms of mental health status as a result of the "one-child" policy. During the process, some family situations cannot be observed. Moreover, parental preferences that cannot be observed may influence the number of children in families. In addition, genetic inheritance may also influence the mental health of the samples. Hence, variable *S* may be endogenous. This study addresses this issue by selecting appropriate instrumental variables. For example, the variable that "whether children are born after the implementation of the 'one-child' policy" (variable *D*) is the instrumental variable of the endogenous explanatory variable that "whether the children are only children" (variable *S*), as shown in Equation (2). Accordingly, the implementation of the "one-child" policy is accurately estimated to generate cause–effect on the mental health of only children. In Equation (1), includes other variables that influence the mental health indicators of the interviewees except *S*. These health indicators include the educational level, monthly family income per capita, working condition, gender, etc., of the interviewees. In Equation (2), includes other explanatory variables that may influence whether the interviewees will become only children aside from the "one-child" policy, such as gender, family income level, and so on.

To strengthen the explanatory power of various variables in the model, the following methods are applied to calculate marginal effects.

Given that the explanatory variables in the bivariate probit model can both directly (Equation 1) and indirectly (Equation 2) influence the mental health indicators of the interviewees, the influence of the correlation must be considered when calculating the marginal effects of various control variables. First, the conditional expectation of the mental health indicators is decomposed as follows:

$$\begin{aligned} E(Y|X) &= P(Y=1|X) \\ &= P(S=1|X)*P(Y=1|S=1,X)+P(S=0|X)*P(Y=1|S=0,X) \\ &= P(Y=1,S=1|X)+P(Y=1\ ,S=0|X) \\ &= \Phi_2\left(X_1\beta_1+\gamma, X_2^*\beta_2^*, \rho\right)+\Phi_2\left(X_1\beta_1, -X_2^*\beta_2^*, -\rho\right) \end{aligned} \tag{4}$$

where X denotes all the relevant control variables, and $\Phi_2(\cdot)$ signifies the cumulative distribution function of the binary joint normal distribution. For the marginal effects of the continuous and binary variables, different computing methods are used.

For the continuous variable x_i, the marginal effects can be represented as follows:

$$\begin{aligned} ME_i &= \partial\{E(Y|X)\}/\partial x_i \\ &= \partial\left\{\Phi_2\left(X_1\beta_1+\gamma, X_2^*\beta_2^*, \rho\right)+\Phi_2\left(X_1\beta_1, -X_2^*\beta_2^*, -\rho\right)\right\}/\partial x_i \\ &= \left\{\varphi\left(X_1\beta_1+\gamma\right)\Phi\left[\frac{X_2^*\beta_2^*-\rho\left(X_1\beta_1+\gamma\right)}{\sqrt{1-\rho^2}}\right]+\varphi\left(X_1\beta_1\right)\Phi\left[\frac{\rho X_1\beta_1-X_2^*\beta_2^*}{\sqrt{1-\rho^2}}\right]\right\}/\beta_{1i} \\ &+\left\{\varphi\left(X_2^*\beta_2^*\right)\Phi\left[\frac{X_1\beta_1+\gamma-\rho X_2^*\beta_2^*}{\sqrt{1-\rho^2}}\right]-\varphi\left(X_2^*\beta_2^*\right)\Phi\left[\frac{X_1\beta_1-\rho X_2^*\beta_2^*}{\sqrt{1-\rho^2}}\right]\right\}/\beta_{2i} \end{aligned} \tag{5}$$

where $\varphi(\cdot)$ and $\Phi_2(\cdot)$ denote the probability density function and the cumulative distribution function of the standard normal distribution, respectively. β_{1t} and β_{2t} denote the coefficients of the continuous explanatory variable x_i of the mental health indicator equation (Equation 1) and the only children equation (Equation 2) in the bivariate probit model. If variable x_i only appears in Equation 1 (or 2), then $\beta_{2t}=0$ (or $\beta_{1t}=0$).

For the binary explanatory variable x_j, the calculation formula of the marginal effects can be represented by the following equation:

$$\begin{aligned} ME_{\mathrm{j}} &= E\left(Y\middle|X, x_j = 1\right) - E\left(Y\middle|X, x_j = 0\right) \\ &= \left\{\Phi_2\left(X_1\beta_1 + \gamma, X_2^*\beta_2^*, \rho\right) + \Phi_2\left(X_1\beta_1, -X_2^*\beta_2^*, -\rho\right)\right\}\Big|_{x_j = 0}^{x_j = 1} \end{aligned} \tag{6}$$

For the endogenous binary variable *S*, the marginal effects can be expressed as follows:

$$\begin{aligned} ME_{\mathrm{S}} &= E\left(Y\middle|S = 1, X\right) - E\left(Y\middle|S = 0, X\right) \\ &= \Phi\left(X_1\beta_1 + \gamma\right) - \Phi\left(X_1\beta_1\right) \end{aligned} \tag{7}$$

The marginal effects of the implementation or non-implementation of the "one-child" policy on whether a child is the only child in the family can be expressed as follows:

$$\begin{aligned} ME_{\mathrm{D}} &= E\left(S\middle|D = 1, X_2\right) - E\left(S\middle|D = 0, X_2\right) \\ &= \Phi\left(X_2\beta_2 + \alpha\right) - \Phi\left(X_2\beta_2\right) \end{aligned} \tag{8}$$

Probit Model. The probit model is applied to analyze the influence of the number of siblings on mental health. This model regards various mental health indicators as latent variables (Y^*). The observed mental health status is regarded as the natural result of *Y** surpassing the zero threshold; hence, the model can be represented as follows:

$$\begin{aligned} \Pr\left(Y = 1\middle|N, X\right) &= \Pr\left(Y^* > 0\middle|N, X\right) \\ &= \Pr\left(\alpha_0 + \alpha N + X'\beta\middle|N, X\right) \\ &= \Phi\left(\alpha_0 + \alpha N + X'\beta\right) \end{aligned} \tag{9}$$

where Φ is the standard normal cumulative distribution function. Dependent variable *Y* includes various mental health indicators, *N* signifies the number of siblings, and *X* denotes other variables that influence the mental health indicators of the interviewees apart from variable *N*.

Data Analysis

The analysis of the empirical results can be divided into two parts. In the first part, the differences between only children and non-only children in terms of mental health status are determined through comparison. In the second part, the number of siblings is further divided to analyze its influence on mental health.

Differences between Only Children and Non-Only Children in Mental Health Status

Among the samples used in this study, non-only children accounted for approximately 34.9%. According to the statistical analysis of the data, the monthly income per capita of families with only children is approximately 623 RMB, whereas that of families with non-only children is approximately 587 RMB. In addition, among the primary mental health indicators, the probability that only children and non-only children will choose to avoid difficulties and problems is 12% and 10.5%, respectively. The probability for only children to experience mental stress is 10.9%, whereas that for non-only children is 7.6%. In terms of the degree of depression, 57.6% of only children exhibit a depression trend, whereas only 44.1% of non-only exhibit such trend. The preceding statistics are simple descriptions of the key indicators. After controlling other variables, the detailed answers to questions regarding how various mental health indicators affect only children and non-only children and what is the influence of the "only-child" policy will be provided.

Self-Affirmation Indicators. Table 1 presents the estimated results of various self-affirmation indicators. Columns (1), (2), and (3) respectively present the regression results of the three indicators, namely, lack of confidence, feeling worthless, and avoiding problems and difficulties. Given that the bivariate probit model has been applied to solve endogenous issues, the regression results of each index are listed in Columns *a* and *b*.

Among the estimated results of the lack of confidence degree equation of the interviewees, the coefficient of only children is positive after controlling other variables, and is significant at the 1% statistical level, which suggests that compared with non-only children, the degree of lack of confidence for only children is significantly higher. In addition, the degree is significantly lower for males than for females. The coefficient of the monthly family income per capita is negative, which suggests that when the family income is high, the possibility that the respondents will lack confidence is low. However, the result is insignificant. For the other two indicators, only children tend to feel worthless more than non-only children; they also exhibit a higher tendency to escape from difficulties and problems. In addition, similar to the lack of confidence indicator, the probability

for females to feel worthless is higher than that for males; females also tend to avoid difficulties and problems more easily.

Table 1. Basic Regression Results of Self-Affirmation Indicators

Explanatory Variables	(1) Degree of Lack of Confidence		(2) Degree of Feeling Worthless		(3) Degree of Avoiding Difficulties	
	a. Lack of Confidence Degree Equation	b. Only Children Equation	a. Feeling Worthless Degree Equation	b. Only Children Equation	a. Difficulty Avoidance Degree Equation	b. Only Children Equation
Only Children	0.673*** (0.195)		0.509** (0.225)		0.611*** (0.168)	
Children Born After the Implementation of the "One-Child" Policy		0.918*** (0.067)		0.890*** (0.065)		0.883*** (0.065
Male	-0.194*** (0.066)	0.262*** (0.066)	-0.057 (0.069)	0.304*** (0.064)	-0.061 (0.080)	0.305*** (0.064)
Log (monthly family income per capita)	-0.047 (0.058)	0.026 (0.060)	0.026 (0.060)	0.059 (0.059)	0.044 (0.065)	0.059 (0.058)
Constant	0.800 (0.511)	-0.246 (0.443)	-0.334 (0.522)	-0.536 (0.428)	-0.903 (0.557)	-0.521 (0.425)
ρ	0.312** (0.120)	0.312** (0.120)	0.248* (0.138)	0.248* (0.138)	0.279** (0.105)	0.279** (0.105)
Observations	2030	2030	2037	2037	2037	2037

*Notes: i) The content in brackets ( ) indicates robust standard error. ii) ***, **, and * respectively denote that the estimated coefficients are significant at the statistical levels of 1%, 5%, and 10%. iii) The educational level, working condition, marital status, year, and urban virtual variables of the interviewees are also controlled. iv) The significance level of ρ is obtained via the Wald test of the hypothesis, that is, ρ = 0.*

The regression results of the only children equation are discussed in this paragraph. Columns (1), (2), and (3) of Table 1 show that instrumental variable *D*, i.e., whether the interviewees are born after the implementation of the "one-child" policy, significantly influences the probability for the interviewees to be only children. The coefficient of variable *D* is positive and significant at the statistical level of 1%, which suggests that the implementation of "one-child" policy considerably influences the choice of families to have only one child. If the interviewees are males, then their parents may decide to have only one child. In traditional Chinese families, the belief of "bringing up sons to support their parents in their old age" prevails. After the implementation of the "one-child" policy, nonrandom reproductive decisions directly influence only children and non-only children

because of the lack of sufficient persuasion. The conditions for the two types of families are different, and they are distinguished from each other on the basis of preference and demand for the number of children. Thus, the date of birth of the interviewees must be controlled. The main objective of this study is to use the bivariate probit model to solve the endogeneity problem. In addition, the monthly family income per capita positively influences the choice to have only one child, but the result is insignificant. An assumption can be made that when the family income is high, the probability that the parents are official workers is also high; hence, under the condition that the punishment for over-reproduction is harsh, parents are inclined to have only one child.

Finally, the correlation coefficient ρ of the random disturbance term in the two equations of the bivariate probit model is 0.312, 0.248, and 0.279, and is significant at the statistical level of 5% and 10%. These results suggest that "whether they are only children" is endogenous in our key explanatory variable. In addition, the coefficients exhibit a positive correlation with the lack of confidence indicator, the feeling worthless indicator, and the indicator for avoiding difficulties. That is, compared with non-only children, the probability that only children lack confidence is higher; moreover, they feel worthless more easily and are more inclined to avoid difficulties and problems.

Table 2. Marginal Effects of Self-Affirmation Indicators

Explanatory Variables	(1) Degree of Lack of Confidence		(2) Degree of Feeling Worthless		(3) Degree of Avoiding Difficulties	
	a. Lack of Confidence Degree Equation	b. Only Children Equation	a. Feeling Worthless Degree Equation	b. Only Children Equation	a. Difficulty Avoidance Equation	b. Only Children Equation
Only Children	0.240*** (0.066)		0.151** (0.064)		0.107*** (0.029	
Children Born After the Implementation of the "One-Child" Policy		0.293*** (0.020)		0.278*** (0.019)		0.275*** (0.019)
Male	-0.069*** (0.024)	0.080*** (0.020)	-0.018 (0.021)	0.092*** (0.020)	-0.012 (0.015)	0.092*** (0.020)
Log (monthly family income per capita)	-0.017 (0.021)	0.008 (0.018)	0.008 (0.018)	0.018 (0.017)	0.009 (0.013)	0.018 (0.017)
Observations	2030	2030	2037	2037	2037	2037

*Notes: i) The content in brackets ( ) indicates robust standard error. ii) ***, **, and * respectively denote that the estimated coefficients are significant at the statistical levels of 1%, 5%, and 10%. iii) The educational level, working condition, marital status, year, and urban virtual variables of the interviewees are also controlled.*

Table 2 shows the marginal effects of the regression results of various indicators. The results suggest that after controlling other relevant variables, only children are more inclined to lack confidence compared with non-only children; the trend of the former is 24% higher than that of the latter. In addition, the probability for males to lack confidence is lower than that for females by 6.9%. As shown in Equation (2), the probability for only children to feel worthless is also higher than that for non-only children by 15.1%. From Equation (3), the probability for only children to avoid difficulties and problems is higher than that for non-only children by 10.7%.

The marginal effects of the only children equation are discussed in this paragraph. In the only children equation of the three indicators, the marginal effects of the influence of the "one-child" policy for families to decide to have only one child are 0.293, 0.278, and 0.275, respectively, at the significance level of 1%. The two coefficients are roughly close to each other because of the slight differences in the samples used. However, the differences are small and can be neglected; that is, the "one-child" policy plays a vital role in effectively controlling population increase. Moreover, in the only children equation, the coefficient of males is significantly positive; that is, male interviewees are more likely to be only children.

Mental Stress and Depression Indicators. Table 3 presents the basic regression results of mental stress and depression indicators. Columns (1), (2), and (3) show the regression results of the degrees of focusing energy, mental stress, and depression, respectively.

After controlling other relevant variables, the only children coefficient is negative, which suggests that the degree of focusing energy of only children is significantly lower than that of non-only children. Meanwhile, columns (2) and (3) suggest that the mental stress of only children is higher than that of non-only children; moreover, the depression trend of only children is higher than that of non-only children. However, the result of the latter is insignificant. In addition, the mental stress degree of males is significantly higher than that of females; by contrast, the depression trend of males is significantly lower than that of females.

For the degree of focusing energy indicator, the correlation coefficient ρ is -0.288, which is significant at the statistical level of 5%. This result suggests that endogeneity exists in the key explanatory variable of "whether they are only children". Moreover, a negative correlation is observed with the degree of focusing energy indicator among the interviewees; that is, only children tend experience more difficulty in focusing their energy than non-only children. For the degrees of mental stress and depression indicators, the correlation coefficient ρ is 0.091 and 0.270, respectively, and significant at the statistical level of 1%. These results suggest that endogeneity exists in the key explanatory variable, which proves that compared with non-only children, only children experience higher mental stress in daily life and can more easily suffer from depression.

Table 3. Basic Regression Results of Mental Stress and Depression Indicators

Explanatory Variables	(1) Energy Focusing Degree		(2) Mental Stress Degree		(3) Depression Degree	
	a. Energy Focusing Degree Equation	b. Only Children Equation	a. Mental Stress Degree Equation	b. Only Children Equation	a. Depression Degree Equation	b. Only Children Equation
Only Children	-0.636***		0.339*		0.714***	
	(0.208)		(0.190)		(0.145)	
Children Born After the Implementation of the "One-Child" Policy		0.920***		0.890***		0.906**
		(0.067)		(0.065)		(0.068)
Male	-0.002	0.263***	0.206**	0.304***	-0.124**	0.263***
	(0.085)	(0.066)	(0.082)	(0.064)	(0.063)	(0.066)
Log (monthly family income per capita)	0.068	0.028	0.058	0.058	0.035	0.040
	(0.075)	(0.060)	(0.069)	(0.058)	(0.052)	(0.061)
Constant	0.623	-0.264	-0.887	-0.538	0.582	-0.381
	(0.698)	(0.442)	(0.548)	(0.425)	(0.450)	(0.444)
ρ	-0.288**	-0.288**	0.091***	0.091***	0.270***	0.270***
	(0.123)	(0.123)	(0.012)	(0.012)	(0.094)	(0.094)
Observations	2035	2035	2037	2037	2035	2035

Note: The same as those in *Table 1*

Table 4 presents the marginal effects of mental stress and depression indicators. Compared with that for non-only children, the probability for only children to focus their energy when performing normal activities is lower by 10.5%. The probability for only children to suffer from mental stress in daily life is higher than that for non-only children by 5.4%. The depression indicator of only children is higher than that of non-only children by 27.6%. In addition, no significant difference is observed between males and females in the degree of focusing energy indicator. However, the mental stress trend for males is higher than that for females by 3.6%. By contrast, the depression probability for males is lower than that for females by 4.6%. In general, males are the backbone of families and bear their burden; hence, they are more inclined to suffer from mental stress. By contrast, males are not inclined to dwell on insignificant issues and are more open-minded; hence, males are less likely to suffer from depression than females.

Table 4. Marginal Effects of Mental Stress and Depression Indicators

Explanatory Variables	(1) Focusing Energy Degree		(2) Mental Stress Degree		(3) Depression Degree	
	a. Focusing Energy Degree Equation	b. Only Children Equation	a. Mental Stress Degree Equation	b. Only Children Equation	b. Depression Degree Equation	b. Only Children Equation
Only Children	?0.105***		0.054*		0.276***	
	(0.034)		(0.029)		(0.053)	
Children Born After the Implementation of the "One-Child" Policy		0.293***		0.278***		0.289***
		(0.020)		(0.019)		(0.020)
Male	?0.000	0.080***	0.036**	0.092***	?0.046*	0.080***
	(0.016)	(0.020)	(0.015)	(0.019)	(0.024)	(0.020)
Log (monthly family income per capita)	0.013	0.008	0.010	0.017	0.013	0.012
	(0.014)	(0.018)	(0.012)	(0.017)	(0.020)	(0.018)
Observations	2035	2035	2037	2037	2035	2035

Note: The same as those in *Table 2*

The marginal effects of the only children equation are discussed in this paragraph. The effects of the implementation of the "only-child" policy on families are 0.293, 0.278, and 0.289, and are significant at the statistical level of 1%. Hence, the influence degree of the "one-child" policy on the decision of families to have only one child is approximately 29%. That is, among the factors which influence families to decide to have only one child, the "one-child" policy accounts for approximately 29%.

Other Indicators. Table 5 presents the basic regression results of the three indicators, i.e., happiness degree, trust toward others degree, and risk taking degree. Given that the indicators of the trust toward others degree and the risk taking degree are only found in the 2009 database, research on these two indicators no longer controls the year variable.

Table 5. Basic Regression Results of Other Indicators

Explanatory Variables	(1) Happiness Degree		(2) Trust toward Others Degree		(3) Risk Taking Degree	
	a. Happiness Degree Equation	b. Only Children Equation	a. Trust toward Others Degree Equation	b. Only Children Equation	a. Risk Taking Degree Equation	b. Only Children Equation
Only Children	-0.426*** (0.144)		-0.281 (0.210)		-0.898*** (0.294)	
Children Born After the Implementation of the "One-Child" Policy	0.890*** (0.065)		0.861*** (0.089)		0.899*** (0.093)	0.890*** (0.065)
Male	-0.009 (0.062)	0.302*** (0.064)	-0.106 (0.092)	0.371*** (0.087)	0.173* (0.098)	0.317*** (0.090)
Log (monthly family income per capita)	0.036 (0.053)	0.061 (0.059)	-0.105 (0.083)	0.098 (0.087)	0.163 (0.100)	0.030 (0.089)
Constant	-1.225*** (0.448)	-0.573 (0.432)	0.895* (0.511)	-0.692* (0.412)	0.645 (0.622)	-0.287 (0.427)
ρ	-0.148** (0.083)	-0.148** (0.083)	-0.307** (0.132)	-0.307** (0.132)	-0.516** (0.169)	-0.516** (0.169)
Observations	2037	2037	1071	1071	984	984

Note: The same as those in *Table 1*

Column (1) shows that the happiness of only children is significantly lower than that of non-only children; however, no significant difference exists between males and females. The regression results in Columns (2) and (3) suggest that no significant difference exists between only children and non-only children in the trust toward others degree. However, in the risk taking degree, the risk taking trend of only children is significantly lower than that of non-only children. Only children lack more sense of security and courage to take risks than non-only children. In addition, the coefficient of males is significantly positive, which suggests that males prefer to take risks more than females, which is basically identical to actual conditions.

Among the three indicators, the results of the only children equation are similar with the results of the two previous indicators; hence, unnecessary details are no longer included in this paper. In addition, the symbols of the correlation coefficient $\tilde{n}$ in three indicator equations is significantly negative, which indicates that compared with non-only children, only children are less happy. Moreover, only children are more inclined to distrust others and lack a sense of security.

Table 6. Marginal Effects of Other Indicators

Explanatory Variables	(1) Happiness Degree		(2) Trust toward Others Degree		(3) Risk Taking Degree	
	a. Happiness Degree Equation	b. Only Children Equation	a. Trust toward Others Degree Equation	b. Only Children Equation	a. Risk Taking Degree Equation	b. Only Children Equation
Only Children	-0.161*** (0.054)		-0.081 (0.060)		-0.267*** (0.097)	
Children Born After the Implementation of the "One-Child" Policy	0.278*** (0.019)		0.269*** (0.026)		0.287*** (0.028)	0.278*** (0.019)
Male	-0.003 (0.023)	0.092*** (0.020)	-0.032 (0.028)	0.113*** (0.027)	0.046* (0.026)	0.097*** (0.028)
Log (monthly family income per capita)	0.013 (0.019)	0.018 (0.018)	?0.031 (0.025)	0.029 (0.026)	0.044 (0.027)	0.009 (0.027)
Observations	2037	2037	1071	1071	984	984

Note: The same as those in *Table 2*

In *Table 6*, Columns (1), (2), and (3) are converted into the marginal effects of the indicators of the happiness degree, the trust toward others degree, and the risk taking degree. As shown in the table, the probability for only children to feel happy is lower than that for non-only children by 16.1%. However, the probability for only children to take risks is lower than that for non-only children by 26.7%. In addition, the probability for males to take risks is higher than that for females by 4.6%.

Influence of the Number of Siblings on Mental Health

The aforementioned results suggest that the mental health status of only children is poorer than that of non-only children. However, would the mental health status of a child be better if he/she had more siblings? The answer to this question will be discussed in this section.

Figure 1 shows the proportion of families with different numbers of children. Among the samples used in this study, the highest number of children in a family is six. As shown in the figure, the number of children in most families is below three. The proportions of families with one, two, and three children are 38.1%, 30.1%, and 43.3%, respectively. Only 1.9% and 1.5% families have five and six children, respectively.

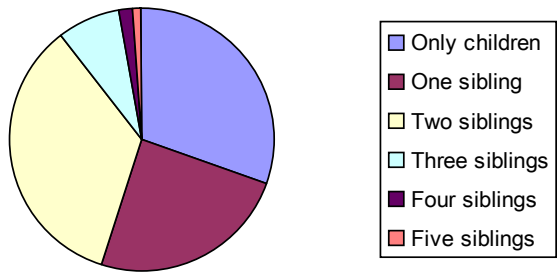

Figure 1. Proportion of Families with Different Numbers of Children

Tables 7, 8, and 9 show the influence of the number of children on various mental health indicators. In the probit model, although a direct interpretation cannot be made toward the coefficient value, the symbols of the coefficients are consistent with the statistical significance and linear regression results; hence, the influences of various factors on the mental health of the interviewees can be interpreted similarly. The regression results presented in *Table 7* suggest that compared with only children, the number of non-only children increase with the increasing number of siblings. Moreover, the degrees of lack of confidence, feeling of worthlessness, and avoidance of difficulties initially present a declining trend and then increases later. That is, compared with only children, interviewees with one to two siblings are more confident and are more inclined to affirm their worth or value. In addition, the probability for the latter to avoid difficulties and problems is lower. Nevertheless, as the number of siblings increases, the difference gradually disappears. In fact, the degrees of lack of confidence and avoidance of difficulties are significantly higher among interviewees with five or more siblings than those for only children.

Table 8 presents the regression results of the mental stress and depression indicators. Compared with only children, the degree of focusing their energy of interviewees with siblings is significantly higher. However, with the increase in the number of siblings, the difference gradually disappears. Meanwhile, the other two indicators, i.e., the degrees of mental stress and depression, are always lower among non-only children than among only children, regardless of the number of siblings. This result can be attributed to the extremely high expectations of parents toward only children as they are growing up; hence, only children experience considerable mental stress. Moreover, when their parents grow old, they will experience the family pattern of "4+2+1" and will shoulder the financial and spiritual burdens of the family. In this aspect, the more siblings a person have, the more the family burdens can be divided among them, which can reduce mental stress.

Table 7. Influence of Numbers of Siblings on Self-Affirmation Factors

	(1) Degree of Lack of Confidence	(2) Degree of Feeling Worthless	(3) Degree of Avoiding Difficulties
One sibling	-0.170**	-0.189**	-0.193***
	(0.078)	(0.084)	(0.071)
Two siblings	-0.288***	-0.199**	-0.045
	(0.089)	(0.097)	(0.084)
Three siblings	-0.212*	-0.107	0.074
	(0.114)	(0.123)	(0.108)
Four siblings	-0.014	0.166	0.131
	(0.213)	(0.271)	(0.239)
Five siblings	0.951***	0.488	0.613**
	(0.338)	(0.339)	(0.295)
Observations	1869	1869	1869

Notes: *i) The content in brackets ( ) denotes robust standard error. ii) ***, **, and * denote that the estimated coefficients are significant at the statistical levels of 1%, 5%, and 10%, respectively. iii) Apart from the number of siblings, the gender, monthly family income per capital, educational level, work condition, marital status, and so on, of the interviewees are also controlled. The fixed effects of years and cities are also controlled.*

Table 8. Influence of the Number of Siblings on Mental Stress and Depression Indicators

	(1) Degree of Focusing Energy	(2) Degree of Mental Stress	(3) Degree of Depression
One sibling	0.219***	-0.247***	-0.340***
	(0.073)	(0.071)	(0.075)
Two siblings	0.053	-0.369***	-0.316***
	(0.087)	(0.080)	(0.081)
Three siblings	0.118	-0.476***	-0.452***
	(0.100)	(0.103)	- (0.104)
Four siblings	-0.202	-0.418**	-0.142
	(0.244)	(0.209)	(0.202)
Five siblings	-0.311	-0.578**	-0.498**
	(0.275)	(0.251)	(0.209)
Observations	1868	1869	1869

Note: The same as those in *Table 7*

Table 9 shows that the influences of the increase in the number of siblings on the happiness and risk-taking degrees of the interviewees initially present an increasing trend before declining. However, for the degree of trust toward others, no significant difference exists among the interviewees with different numbers of siblings.

Table 9. Influence of the Numbers of Siblings on Other Indicators

	(1) Happiness Degree	(2) Trust toward Others Degree	(3) Risk-Taking Degree
One sibling	0.240***	0.211	0.082***
	(0.072)	(0.118)	(0.010)
Two siblings	0.363***	0.138	0.047
	(0.078)	(0.133)	(0.107)
Three siblings	0.134	0.190	0.271**
	(0.111)	(0.175)	(0.126)
Four siblings	-0.138	0.620	-0.041
	(0.203)	(0.403)	(0.207)
Five siblings	-0.031	-0.045	0.027
	(0.239)	(0.406)	(0.306)
Observations	1869	980	980

Notes: The same as those in *Tables 7* and *8*

Discussion

Domestic and foreign arguments on the implementation of the "one-child" policy never stop. In reality, the influencing factors that determine the fertility decision of a family are relatively complicated. However, the empirical results of this study suggest that the "one-child" policy has played a decisive role. The implementation of this policy for 36 years has fundamentally changed the family structure in China. An increasing amount of data suggests that the traditional large family model has gradually disappeared in China. The resulting lack of kinship will exert immeasurable influences on individuals, families, and the entire society.

After applying the bivariate probit model to eliminate endogenous effects, the research results suggest that "fewer births" do not necessarily mean "better births". Moreover, a "quality–quantity alternative" relation does not exist among the population to a certain degree. The special family structure leads to the over protectiveness of parents and older generations toward their only children. When these only children grow up, they have to face difficulties and solve problems

independently without the help of their elders; hence, they tend to shirk their responsibilities and are inclined to avoid challenges. When difficulties cannot be conquered, these only children easily lose confidence and feel frustrated, which increase their mental burdens. Furthermore, the way of life that only children have become accustomed to during their childhood tends to make them self-centered. When they grow up, they have to accept more responsibilities from their family and the society. Such difference in their course of life exerts a considerable negative influence on their sense of happiness and even endangers their mental health. For most only children, the real crisis begins when they reach middle age, i.e., when their parents grow old and suffer from deteriorating health, which results in the problem of caring for the elderly. Without the help of siblings, all the burdens are shouldered by only children in their middle - age, who are thus overwhelmed by stress. Under such burden, do they still have sufficient energy left to contribute to the development of society? To a certain degree, the mental health status of non-only children is obviously superior to that of only children. However, this finding does not necessarily mean that the larger the number of siblings, the better the mental health status of children. After further controlling the number of siblings, researchers have determined that mental health gradually declines with the increase in the number of siblings. When the number of children in families increases, the limited family resources and the concerns of the parent will no longer be able to satisfy the basic demands of each child, which is also unfavorable to the healthy development of children.

Hence, to promote the mental health of the population and improve its overall quality, the "one-child" policy should be relaxed drastically. Note, however, that relaxing the "one-child" policy does not equate to comprehensively opening the family planning policy. Under the premise of guaranteeing the basic state policy of family planning, the focus of the policy should be shifted to control the number of children in families within a reasonable range, which will not only guarantee care from the parents as well as companionship and the sharing of burdens among siblings, but also achieves the effective allocation of family resources. Moreover, attention should be paid to the influences of the growth environment and education on the future of only children to enhance the natural combination of family education, school education, and social education. Appropriate family education notions, a positive school education atmosphere, and proper social value orientation can prevent the development of negative mental traits during the growth of only children. In addition, the government should implement the corresponding policies to improve the social security system. The government and the children should work together in caring for the elderly to reduce the responsibilities of children, which will undoubtedly alleviate the mental pressure of only children. Such joint efforts in multiple levels will be beneficial to the overall promotion of population quality in China.

Although it can control the population, the strict implementation of the "one-child" policy will also cause population quality to decline, which is one of the

main reasons why the 5th Plenary Session of the 18th CPC Central Committee decided to comprehensively implement the policy that only children couple can have two children ("two-children" policy). Simultaneously, this action signifies that the implementation of the "one-child" policy for over 30 years has officially ended. The implementation of the "two-children" policy will definitely widen the family scale. How will the increase in the number of children influence the mental health of children? Will it optimize the overall mental quality of the population to a certain extent? To answer these questions, a 10-year tracking investigation will be conducted in the future to determine whether "two-children" families are satisfying the requirements of the policy. The evaluation will be conducted on the basis of the investigation results on the influences of the two policies to compare the differences in the mental health children and the overall quality of the population under the two policies. Such evaluation will be the key to subsequent research in the future.

Conclusion

This study first applied different methods to analyze the influence of the "one-child" policy of China on the fertility decisions of families. On this basis, the relation between the number of children in a family and the mental health of children was also discussed. The results suggest that the implementation of the "one-child" policy significantly and negatively affects the mental health of only children and the overall promotion of the quality of population, and thus, impedes the growth of human capital to a certain extent. This research objectively evaluates the long-term influence of the "one-child" policy on the mental health of only children in the quantized perspective and deepens understanding on the relation between this family planning policy and the overall quality of the population. The obtained results in this study can guide the government in controlling the population and placing additional emphasis on the important role played by a family planning policy in promoting population quality. The conclusions also can provide a theoretical reference for the comprehensive implementation of the "two-children" policy.

The limitation of this study is that it only involves the mental health of children. According to the World Health Organization, health should cover two aspects: mental health and physical health. Therefore, a discussion on the overall quality of the population and the health of the human capital should be carried out in two angles, i.e., mental health and physical health, to guarantee comprehensiveness. In the future, the scope of the research shall be expanded to include the physical health of only children, and thus, comprehensively identify the long-term effects of the "only-child" policy on the overall quality of the population, human capital, and economic development of China.

Acknowledgement

This work was supported by Henan Province Office of Education Humanities and Social Science Research Foundation (No.2015-QN-097).

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