Routledge
Taylor & Francis Group

Economic Research-Ekonomska Istraživanja

ISSN: (Print) (Online) Journal homepage: https://www.tandfonline.com/loi/rero20

Research on intergenerational transmission of Chinese residents' income: Based on data from ten surveys of Chinese Family Tracking Survey from 1989 to 2015

Yang Liu & Melanie Faye

To cite this article: Yang Liu & Melanie Faye (2021): Research on intergenerational transmission of Chinese residents' income: Based on data from ten surveys of Chinese Family Tracking Survey from 1989 to 2015, Economic Research-Ekonomska Istraživanja, DOI: 10.1080/1331677X.2021.1875862

To link to this article: https://doi.org/10.1080/1331677X.2021.1875862

ECONOMIC RESEARCH-EKONOMSKA ISTRAŽIVANJA
https://doi.org/10.1080/1331677X.2021.1875862

Research on intergenerational transmission of Chinese residents' income: Based on data from ten surveys of Chinese Family Tracking Survey from 1989 to 2015

Yang Liu[a] and Melanie Faye[b]

[a]Data research center, Southwestern University of Finance and Economics, Chengdu, China; [b]Big Data Operation Center, Alibaba Network Technology Co., Ltd, Hangzhou, China

ABSTRACT

This article uses the rank-ordered probit estimation method and data from the 10 Chinese Family Tracking Survey from 1989 to 2015 to systematically study how the family background, especially the parental income, of urban and rural residents in China since its opening affects the intergenerational transmission of income and income inequality. The results show the following: ① The higher the income of parents is, the higher the income of their offspring. When parents are middle income or above, the probability of their children earning an upper-middle or high income increases significantly. ② Although the income of mothers is low, its impact on children's income is greater than that of the father's income. If the mother's income is middle, upper-middle, or high income, it will increase the probability of her children earning a high income by 12.17%, 28.16% and 45.90%, respectively, while the corresponding influence from the father's income is 9.62%, 20.69% and 43.82%. ③ For children, the degree of intergenerational income inequality is greater for women than for men, and it is higher in cities than in rural areas. ④ The intergenerational transmission of income is persistent across multiple generations, but the transmission from parents is much higher than from grandparents. It is also difficult for the offspring of a lower-income couple to obtain a higher income. These conclusions are robust to examining different samples and examining the predicted impact of various measures of family background on the income of offspring. Based on the results, this article puts forward policy recommendations to improve intergenerational income consolidation and reduce income inequality.

ARTICLE HISTORY
Received 31 July 2020
Accepted 9 January 2021

KEYWORDS
Probit estimation; intergenerational income; intergenerational transmission; income inequality

JEL CODES
D10; D60; J30

CONTACT Yang Liu 763735929@qq.com

Supplemental data for this article is available online at https://doi.org/10.1080/1331677X.2021.1875862.

1. Introduction

Intergenerational income mobility refers to the degree of correlation between the incomes of parents and their offspring. The intergenerational transmission of poverty, a persistent problem, has received increasing attention from governments and academic circles in various countries. The intergenerational transmission of poverty has also become a topic of global concern. In an economy with low intergenerational income mobility, a gradually widening income gap during the parents' lifetime will continue into that of the offspring, resulting in numerous "poor second generations", "government second generations" and "rich second generations". If the intergenerational income mobility of a society stagnates, the income inequality structure of the first generation is duplicated in the economic environment of the second generation, preventing the individuals at the bottom of the income distribution from finding ways and methods to move up the distribution, reducing the efficiency of economic incentives, solidifying the stratification of society, and finally, forming a pattern of polarization among members of society.

At present, China's economy is in a state of rapid development. With the development of the economy in recent years, the problem of social stratification in China has become increasingly prominent, the gap between the rich and the poor has become increasingly larger, and social contradictions have gradually intensified. At the same time, China's income distribution, labor market, and employment system have also undergone great changes. Therefore, has the intergenerational income mobility in China changed as well? If so, how large are these changes? Especially in recent years, the intense social stratification resulting in roles being passed on to the second generation has become a media sensation. The media and the public are paying close attention to issues such as the solidification of China's social structure and the difficulties of the bottom of society in terms of upward mobility. To this end, this article focuses on the following questions: Since the founding of the People's Republic of China, especially since China's opening, to what extent has family background affected the future income levels of children? What is the difference in the impact of the mother's and the father's income levels on the children's income levels? Does the intergenerational transmission of income differ depending on the matching status of gender, urban or rural status, birth cohort, or marital status? By revealing the characteristics and internal mechanisms of intergenerational income transmission in China, this article proposes policy recommendations to reduce inequality in income opportunities. Research on these issues is helpful for deeply understanding problems in the income distribution and has important practical value for improving the economic and social efficiency of developing countries (Lopreato, 1965) first defined social mobility as the transformation of individuals or social objects or values from one location to another, and divided it into vertical mobility and horizontal mobility, intra-generational mobility and inter-generational mobility. (Becker & Tomes, 1979; Tomes, 1986) pointed out that the study of income distribution not only includes the income inequality of different families in the same generation (usually Gini coefficient, Lorentz curve and other indicators), but also pays attention to the dynamic income inequality between generations. Equality is the flow of intergenerational income. They pointed out that the parent's production decision-making goal is to

maximize family utility, and the size of the utility depends on the parent's consumption, the quantity and quality of offspring (using income as a measure of offspring's quality). In order to maximize the utility of the family, parents will invest in human capital and non-human capital for their children to increase the income of their children. Their empirical research on the United States shows that the intergenerational income elasticity coefficient is approximately 0.2. This result has been questioned a lot. Further research by scholars shows that when using 1-year father-son income data, the elasticity coefficient is between 0.25 and 0.35, but if it is a 5-year average salary, the elasticity coefficient rises to 0.4, and when using 16-year data, it rises to 0.6. The 200% wage gap between parents will become 120% in children after 30 years (Aaberge et al., 2002; Kan et al., 2015; Mazumder, 2001, 2005). This shows that the use of single-year father-son income data will underestimate the intergenerational income elasticity coefficient, and the long-term impact of the family on the income status of offspring is greater than the short-term impact.

With the continuous improvement of research methods and the gradual enrichment of micro data, researchers' research on income distribution has begun to develop in depth. Among them (Blalock et al., 1968) was the earliest economist who discussed the relationship between parental income and offspring's income. Their research believes that the impact of parental income on children's income is very weak, "the United States is a continent full of opportunities." And used the correlation coefficient between the income of parents and the income of offspring to estimate intergenerational income mobility. They calculated the correlation coefficient of 307 in Yorkshire, England to the income of fathers and children, and the value was about 0.17. After their research, Atkinson (1980) summarized two commonly used methods for estimating intergenerational income mobility: one is to use transformation matrix estimation, and the other is to use a multiple regression model method based on logarithmic income (Tomes, 1986). The estimated intergenerational income elasticity of father and son is about 0. 2. Their conclusions support the former study, that is, the intergenerational income mobility in the United States is maintained at a high level, and there is no obvious correlation between the incomes of parents and offspring in American society.

In recent years, the research on intergenerational mobility has shifted from static to dynamic time trends. On the basis of the (Becker & Tomes, 1979) model, Black and Devereux (2010) theoretically discussed which factors led to the national differences in social mobility under a utility maximization model. (Chul-InLee et al., 2009) used the gradual accumulation of samples to estimate the change in intergenerational income elasticity in the United States from 1977 to 2000, and found that the United States had no obvious trend of change during this period. Nicoletti and Ermisch (2007) estimated that intergenerational mobility in the United Kingdom declined between the late 1950s and the 1970s (Ichino et al., 2010). A comparison of data from ten countries found evidence that public education expenditure is negatively correlated with intergenerational income elasticity.

Regarding the measurement of the internal mechanisms underlying intergenerational income mobility, one branch of the literature mainly discusses the role of

certain intermediate variables in intergenerational income mobility; this method of analyzing the mechanism is usually called the intermediate variable method. This research method can be further subdivided into two approaches: One is to add the children's years of education, health and other human capital variables into the regression equation to obtain the conditional intergenerational income elasticity and to combine the conditional intergenerational income elasticity with the unconditional elasticity; the next step is to compare the two elasticities of intergenerational income, identify the degree of decline of the former relative to the latter, and judge the importance of human capital factors such as education or health to intergenerational income mobility (Eriksson & Goldthorpe, 2002); the other approach is to estimate the proportion of a group or a certain human capital factor that determines the total elasticity of the explainable intergenerational income elasticity (Blanden et al., 2006). Another branch of the literature focuses on the decomposition of the different transmission channels that affect intergenerational income mobility. The most representative study is Chakraborty (2004). The author decomposes the factors affecting intergenerational income elasticity into environmental factors and genetic factors and discusses the corresponding contribution rate of the two influences to intergenerational income mobility.

The current research on intergenerational income mobility in China is not perfect, and there is no definite conclusion on the level of Chinese intergenerational income mobility. Due to the relatively complex income data in China, existing studies have inconsistent definitions of income, and the choice of samples is also quite different. This article draws on existing research results, optimizes existing estimation methods, and uses all household survey data (1989–2015) from the China Health and Nutrition Survey (CHNS) to discuss in detail the family background of urban and rural residents in China since its opening. In particular, we study how the income of parents affects intergenerational income transmission and income inequality. The characteristics and internal mechanisms underlying intergenerational income transmission in China are revealed, and policy recommendations to reduce the inequality in income opportunities are proposed.

2. Mechanism analysis

Specifically, the intergenerational transmission mechanism of income includes three aspects. One is to improve the ability of children to obtain income through human capital investment such as education to realize the intergenerational transmission of income Oded and Joseph (1993) believes that under the condition that the capital market is imperfect and the cost of children's education is high enough, rich families are more capable of investing in human capital than poor families, so that the children of rich families can get higher income (Fernandez & Rogerson, 1996) believes that under balanced conditions, the poor and the rich will live in different communities, and children from poor families will have fewer opportunities for high-quality education and lower levels of education. This makes poverty intergenerational. Can be passed on Tsiddon (1997) believes that if school formal education is the only form of human capital formation, then the parent's human capital does

not affect the children's effort in school Fan (2003) believes that low parental human capital will weaken children's learning effort, and low children's learning effort is an important reason for the transmission of poverty between generations. In addition, Becker et al. (1990), Gershanovich (2004), and Tsiddon (1997) have also begun to pay attention to the family environment, especially the role of parents' human capital on the formation of children's human capital. Recent studies include: Louw et al. (2007) studied the situation before and after the reform of universal secondary education in Finland from 1972 to 1977, and pointed out that this reform reduced the intergenerational income correlation by 20%. Jo et al. (2007) found that South Africa's intergenerational mobility during the period 1970–2001 has been greatly improved, a larger part of the reason is that South African children have more opportunities for education. The second is the genetic mechanism. The development of genetic engineering research continues to reveal the role of genes in inheritance, especially the inheritance of ability. But if inheritance is the main mechanism of income transmission between generations, then external public policies aimed at enhancing equity are futile. This research mainly focuses on the study of reference samples, that is, measuring the intergenerational income elasticity between the only child of the biological father and the only child of the non-biological father, so as to show the influence of genetic talent on the intergenerational income. (SG Ferreira & Veloso, 2006) estimates found that whether it is genetic factors before birth or nurturing after birth, both have a significant impact on intergenerational mobility, but genetic factors are more important between biological father and son, while education and other acquired factors Nurturing is even more important between adoptive parents and children Pekkala and Lucas (2007) obtained similar results, that is, there is a small positive connection between the education level of the adopted children and their adoptive mothers, while the same mother and her biological children have a considerable positive connection. Link. Ability is largely influenced by genes. Parents' abilities can be passed on to their children through genes, which in turn affect their children's income. Since parental ability is positively correlated with parental income, although it is difficult for us to directly measure the effect of genetic inheritance on intergenerational income mobility, it can still be approximated that, based on observable means such as education, intergenerational income The remaining part of the flexibility can be attributed to the impact of parental income on children's income through unobservable channels such as genes. The third is the selection mechanism of marriage spouse. That is, a person tends to marry someone who has similar income, education and status to himself and his parents. Kremer's (1997) research found that in American families, the correlation between spouses' educational level reached 0.6. The study found that the personal income of husband and wife has a strong and equal correlation with the income of their respective parents and the income of spouse's parents (Blanden, 2005). A study in the United Kingdom pointed out that the relationship between the income of the spouse and the income of the parents is very large, even greater than the relationship between the income of oneself and the parents, and compared with men, the spouse's choice is right. The continuity of women's intergenerational mobility is more important.

Table 1. Descriptive statistics of annual income of parents and children.

Personal income	Father	Mother	Child					Birth cohort		
			Total	Male	Female	City	Rural	1930–1949	1949–1980	1980–1995
Average	16359	14273	18614	18926	18142	19680	18127	11519	17711	23487
Variance	4.177	4.178	4.315	3.986	4.730	4.947	3.898	4.832	4.442	3.316
Number	16497	16497	16497	8407	8090	7440	9057	252	9411	6134

Source: The Authors.

3. Model, Data selection, descriptive statistics, and basic regression

3.1. Data

The data in this article are collected from the Chinese Family Tracking Survey (CFPS) database from 1989 to 2015. The total number of observations in the ten surveys is 17,449, and the time span covered is 27 years. The reasons for using this database are as follows: ① The survey scope is wide and includes many indicators. It contains data on urban and rural households' demographic structures, occupational backgrounds, education levels, etc. ② This survey is the longest-running survey that collects microdata in China. Ten waves have been conducted so far between 1989 and 2015; ③ There is wide variation across survey subjects. The survey has a large number of observations, and the surveyed households differ greatly in many respects, such as their geographic location, economic development level, and living habits, and they are very representative.

3.2. Data processing and descriptive statistics

In the existing literature, when estimating intergenerational income mobility, one difficulty is that it is impossible to determine the long-term income level of offspring. If the offspring's long-term income level is proxied by the offspring's income when they first started working, measurement error will be introduced. Therefore, the sample used in this article is the sample of adult laborers aged 18-65 years, and those individuals who reported not yet working or working for fewer than five years on the questionnaire are excluded because some of those respondents are still in school. Some of the observed respondents had just begun working, and unstable work may cause dramatic fluctuations in income levels. The observations with income data that do not meet the requirements are dropped, and the average of personal income from the years 2013, 2014, and 2015 is used as the individual's personal income.

According to the classification standards of the Bureau of Statistics of the People's Republic of China, the income distribution is divided into four levels, namely, the low-income group (personal disposable income below 11529 yuan per year), middle-income group (personal disposable income of 11530-40924 yuan per year), upper-middle-income group (personal disposable income of 40925-71993 yuan per year), and high-income group (personal disposable income of more than 71994 yuan per year); the groups are represented by the dummy variables 1, 2, 3 and 4, respectively. The descriptive statistics for some of the indicators are as follows:

The descriptive statistics in Table 1 illustrate the following basic facts. First, overall, the annual income of children is significantly higher than that of their parents. The

average annual income of fathers is RMB 16,395 and of mothers is RMB 14,273. The ratio of males to fathers income is high. Second, in terms of gender and region, the income of male offspring is slightly higher than that of female offspring, while income in urban areas is higher than that in rural areas. Finally, offspring income has increased significantly over time. The income of offspring born after China's opening is significantly higher than that of offspring born before the opening and is almost twice the income of offspring born before the founding of New China.

3.3. Variable definitions

This article studies how family background, especially the income level of parents, affects the income level of children. Therefore, the explained variable variable is the income level of the child, and the core explanatory variable is the income level of the parents. To solve possible endogeneity problems, the following control variables are added to the analysis: whether the child is male (yes is 1, no is 0); whether the child's date of birth is after the China's opening (yes is 1, no is 0); whether the focal child has any siblings excluding cousins (yes is 1, no is 0); Parents' respective years of education; the penetration rate of compulsory education (elementary and junior high school) in rural and urban areas; whether the child lives in a city (non-hukou location; yes is 1, no is 0). Other control variables such as the family's social status and the child's personal effort are also included.

The income level of parents may directly or indirectly affect the income level of offspring through various channels (Chevalier & Lanot, 2002; Ferreira & Gignoux, 2014). In fact, even the ability of individuals to earn an income will be passed from the previous generation to the next generation to a certain extent. A high parental income may improve the income of the offspring. Therefore, this article analyzes the parents' income level as an important component of family background.

The existing literature shows that the social status of a family can directly affect family income, social resources, etc., thereby affecting the education level of children, but this variable cannot be directly measured. The current family structure in China is estimated using the survey data. In this paper, the occupational index of the father is used as a proxy variable for the family's social status (Lauer, 2003; Valbuena, 2011). According to the unified division of the Ministry of Social Security of China, work is divided into the following four categories: advanced nonmanual labor, general nonmanual labor, industrial and tertiary-industry manual labor, and agricultural manual labor. These categories are also included in the model as dummy variables.

In this paper, the offspring's own effort is measured with reference to (Wei z & Zhanli M,2019) and other ideas. Taking the relative level of effort within a generation and the level of income influenced by the family environment into account, individuals of a given generation's own effort is measured as follows:

The child's personal effort = (the child's income – the average income of the child's peers) - (the child's parents' income – the average income of the parents' peers)

The above formula indicates that the level on effort of a particular offspring is depicted by two factors. The first part measures the additional income earned by the offspring as a whole, and the second part measures the additional income brought in

Table 2. Basic regression results.

		Overall	Male	Female	Rural	City	1930–1949	1949–1980	1980–1995
Reg 1	Father	0.3529***	0.3233***	0.4081***	0.3187***	0.3497***	0.1027	0.2647***	0.3665***
		(0.012)	(0.0144)	(0.0207)	(0.0146)	(0.0222)	(0.1570)	(0.0154)	(0.0192)
Reg 2	Mother	0.3655***	0.3065***	0.4607***	0.3157***	0.3855***	0.3598	0.2766***	0.3139***
		(0.0120)	(0.0144)	(0.0205)	(0.0147)	(0.0223)	(0.2687)	(0.0172)	(0.0162)
Reg 3	Father	0.2122***	0.2171***	0.2160***	0.2127***	0.1879***	0.0958	0.1833***	0.2382***
		(0.0145)	(0.0175)	(0.0245)	(0.0169)	(0.0274)	(0.1559)	(0.0184)	(0.0218)
	Mother	0.2423***	0.1813***	0.3343***	0.2038***	0.2695***	0.3542	0.1634***	0.2093***
		(0.0145)	(0.1070)	(0.0248)	(0.0170)	(0.0278)	(0.2705)	(0.0204)	(0.0184)
Reg4	Father	0.1766***	0.1657***	0.2164***	0.2578***	0.3826***	0.0542	0.1682***	
		(0.0124)	(0.0167)	(0.0217)	(0.02641)	(0.0212)	(0.1982)	(0.0126)	
	Mother	0.2064***	0.1647***	0.3581***	0.2068***	0.3656***	0.35972	0.1668***	
		(0.03457)	(0.1645)	(0.0487)	(0.0982)	(0.084)	(0.2798)	(0.0982)	
Reg5	Rural area		0.2585***	0.2063***	0.2168***		0.1068	0.2482***	
			(0.2482)	(0.0215)	(0.0167)		(0.1487)	(0.01598)	
Reg6	City		0.3449***	0.3149***		0.2542***	0.2815	0.2745***	
			(0.1568)	(0.0216)		(0.0357)	(0.2352)	(0.0165)	

Note: *, **, *** mean significant at the 10%, 5%, and 1% significance level respectively. The standard deviation is in parentheses below.
Source: The Authors.

by the family background, and the subtraction of the two indicates the additional income earned by the offspring through their own efforts. Accordingly, the effort variable may be positive or negative; and the larger value of the effort variable is, the more effort the offspring will represent.

3.4. Basic regression results and discussion

First, simple linear regression is used to describe how the income level of parents affects the income level of their offspring. The basic regression equation is as follows:

$$Y_{1i} = \alpha + \beta Y_{0i} + \varepsilon$$

where Y_{1i} is the income of the offspring, Y_{0i} is the income of the father or mother, and β is the regression coefficient. The higher the value of the coefficient is, the greater the influence of the parents' income level on the child's income level.

The basic regression results are shown in Table 2. Regression 1 and regression 2 use the income of the father and of mother, respectively, as the explanatory variable, and the income of the child as the explained variable for regression; the explanatory variables for regression 3 include both the income of the father and mother. The explanatory variables of regression 4 included the years of education of the father and mother, while regressions 5 and 6 used compulsory education (primary and junior high school) penetration rates as explanatory variables for rural and urban areas respectively.

First, the coefficients for the offspring whose birth date is before the founding of New China are too small due to the small sample size, but all other coefficients are significant at the 1% level. Overall, the coefficient on father's income is 0.3529, and the coefficient on mother's income, 0.3655, is slightly larger than that on father's income. Similarly, the results of the regression that includes both father's and mother's income also shows that the regression coefficient on mother's income (0.2423) is

slightly higher than that on father's income (0.2122). . Combined with the descriptive statistics, these results imply that although the mother's income level is lower than that of the father, its impact on the offspring's income level is greater.

Second, regression 1 and regression 2 show that the regression coefficients of females are significantly higher than those of males. An increase in the income of fathers (mothers) of one yuan increases their daughter's income by 0.4081 yuan (0.4607 yuan), but their son's income only increases by 0.3233 yuan (0.3065 yuan). Considering urban and rural areas, the coefficient values for those who live in urban areas are significantly higher than for those in rural areas. Each increase in parents' annual income increases the income of urban children: by 0.3497 yuan for an increase in the father's income and by 0.3855 yuan for an increase in the mother's income. However, in rural areas, children's income increases by only 0.3187 yuan when the father's income increases by 1 yuan and 0.3157 yuan when the mother's income increases. for children's birth dates, the coefficients of parents' income for children born after China's opening were significantly higher than those for children born before, except for the small sample of children born before the founding of the People's Republic of China. From the above analysis, it is clear that the occurrence of intergenerational consolidation of income is most serious for female offspring, offspring living in urban areas, and offspring born after China's opening. In addition, the results of regression 3 show that parents have different degrees of influence on the income levels of their sons relative to that of their daughters. For male offspring, each increase in the income of fathers and mothers increases income by 0.2171 yuan and 0.1813 yuan, respectively. For female offspring, the situation is the opposite. Each additional yuan in the income of fathers and mothers increases the income of female offspring by 0.2160 yuan and 0.3343 yuan, respectively. It can be seen that the income of fathers has a greater impact on the income of their sons and of mothers on daughters.

Third, it can be seen from the results of regression 4 that, on the whole, the higher the parents' years of education, the higher the income of their children, and the influence of the mother is stronger than that of the father. The effect of parental education years on children is more obvious in urban areas. After 1980, that is, after China's reform and opening up, the effect of parents' educational level on children's human capital acquisition was further strengthened. It can be seen that parents' years of education are an important factor in determining children's income, and the mother's years of education have a significantly higher impact on children than fathers. The growth of children in the family is more affected by the mother than by the father. This may be the main reason. It is because the mother plays a more important role in the family, so the education level of the mother will affect the formation of the child's human capital.

Fourth, from the results of Regression 5 and Regression 6, it can be seen that, whether in rural or urban areas, universal compulsory education has a significant positive impact on the increase of children's income, but the impact in urban areas is far greater rural area. Basic education is closely related to regional economic development. Unbalanced and inadequate economic development will lead to unbalanced development of education and inequality in the income of offspring. Mainly reflected

Table 3. Regression coefficients for the effect of parents' and grandparents' income on their offspring's income.

	Reg 1	Reg 2	Reg 3
Parent generation	0.3794***	0.4283***	
	(0.0177)	(0.0174)	
Grandparent generation	0.1864***		0.1714***
	(0.0120)		(0.0249)
Constant	4.7285***	5.8837***	4.7528***
	(0.8047)	(0.0497)	(0.0537)

Note: *, **, *** mean significant at the 10%, 5%, and 1% significance level respectively. The standard deviation is in parentheses below.
Source: The Authors.

in two levels. First, the distribution of high-quality teachers is uneven, and the supply side of high-quality education in poor areas faces a large gap. Due to the relative shortage of financial resources, the wages, benefits, and housing conditions of teachers in poor areas are not as good as those in developed areas. Under the adjustment of the market mechanism, a large number of high-quality teachers flow into urban areas. Second, due to the lack of total educational resources, residents in poor rural areas have a relatively fierce thirst for high-quality educational resources, leading to prominent spillover effects in resource distribution and low efficiency in the use of educational resources.

3.5. Results and discussion of the analysis of intergenerational income transmission persistence

Based on the results of the above regressions, three generations—grandparents, parents and offspring—are included together in the next regressions. The regression coefficients of intergenerational income among the three generations are analyzed. There are two special notes regarding the data processing: ① The highest annual income of the parent is recorded as the annual income of the parent; ② The income of either the father or mother of the parent with the highest income is selected as the annual income of the grandparent. This results in 4747 observations. In this sample, the average income of the children is 20,149 yuan, the average income of the parents is 16,481 yuan, and the average income of the grandparents is only 4777 yuan. The regression coefficients of the intergenerational income for the full sample of offspring, parents and grandparents are calculated, as shown in Table 3. The coefficients are all positive and significant at the 1% level. These positive estimates show that the intergenerational transmission of income is persistent. Comparatively speaking, the regression coefficient of the parents' income is much larger than that of the grandparents' income, indicating that the parents' level of income has a significantly greater impact on the income of the offspring.

4. Results, discussion and robustness tests

4.1. Results

In the previous section, the characteristics of and facts about intergenerational income transmission in different regions, different time periods, and different families in

Table 4. Rank-ordered probit regression results.

	Reg 1	Reg 2	Reg 3	Reg 4	Reg 5
Father is middle income	1.5055***	1.5322***	1.5081***	1.5417***	0.2391***
	(0.0448)	(0.0494)	(0.0501)	(0.0507)	(0.0369)
Father is upper-middle income	2.4850***	2.4862***	2.4585**	2.4351***	0.4244***
	(0.0646)	(0.07360)	(0.0742)	(0.0749)	(0.0542)
Father is high income	3.7906***	3.7686***	3.8093***	3.7520***	0.7979***
	(0.1128)	(0.1340)	(0.1351)	(0.1370)	(0.1011)
Mother is middle income	1.6529***	1.6299**	1.5669***	1.5493***	0.2904***
	(0.0511)	(0.0569)	(0.0584)	(0.0588)	(0.0449)
Mother is upper-middle income	2.6792***	2.7240*	2.6633*	2.6129***	0.6667***
	(0.0757)	(0.0856)	(0.0870)	(0.0877)	(0.0654)
Mother is high income	3.5278***	3.6195***	3.5763***	3.5439***	0.8444***
	(0.1795)	(0.2146)	(0.2170)	(0.2194)	(0.1714)
Father's occupation is industrial or tertiary-industry manual labor		0.4644***	0.4758***	0.2784***	0.4710***
		(0.0420)	(0.0441)	(0.0317)	(0.0391)
Father's occupation is general nonmanual labor		0.5974	0.6508***	0.4741***	0.6960***
		(0.0857)	(0.0864)	(0.0883)	(0.0745)
Father's occupation is high-level nonmanual labor		0.8017***	0.8359***	0.6356***	0.8326***
		(0.0617)	(0.0630)	(0.0649)	(0.1714)
Female offspring			−0.0060	−0.0035	−0.0836**
			(0.0358)	(0.0360)	(0.0301)
Children born in 1930-1949			−1.1210***	−1.2317*	−0.1937*
			(0.2270)	(0.2324)	(0.1828)
Children born in 1980-1995			0.1889***	0.2577***	0.3557***
			(0.0402)	(0.0409)	(0.0347)
Offspring living in the city				0.5196**	0.4280***
				(0.0449)	(0.0398)
Effort of offspring	0.5495***	0.5475***	0.5357***	0.5383***	
	(0.0858)	(0.0378)	(0.1740)	(<0.0000)	

Note: *, **, *** mean significant at the 10%, 5%, and 1% significance level respectively. The standard deviation is in parentheses below.
Source: The Authors.

China were analyzed. This section focuses on how family background, especially the income level of parents, affects the income level of offspring even when controlling for many factors. Based on the theoretical model, the rank-ordered probit model is used to estimate the following equation:

$$E_i = \beta_1 E_{1i} + \beta_2 E_{2i} + \psi FB_i + \varepsilon_i$$

where

$$E_i = \begin{cases} 1 & \text{if } E_i \mu_1 \\ 2 & \text{if } \mu_1 < E_i \mu_2 \\ 3 & \text{if } \mu_2 < E_i \mu_3 \\ 4 & \text{if } \mu_3 < E_i \end{cases}, \mu_1 \text{ is the low-income group, } \mu_2 \text{ is the middle-income group,}$$

and μ_3 is the upper-middle-income group.

The income level of each surveyed individual and his or her parents are divided into four categories as described in previous sections, namely, the low-income, middle-income, upper-middle-income, and high-income groups, where each group is captured through dummy variables added to the model. E_{1i} is the father's income level, E_{2i} is the mother's income level, and FB_i is a vector of control variables discussed above. The regression results are shown in Table 4. Regression 1 adds only the income levels of the parents as explanatory variables, regression 2 controls for the

social status of the family, regression 3 accounts for the impact of offspring gender and birth cohort on income levels, and regression 4 adds the urban-rural variables to investigate the impact of location on the income of offspring; as a comparison, regression 5 removes the variable for the individual's personal effort.

5. Discussion

On the whole, the explanatory variables (parents' respective income levels) and most of the main control variable coefficients are significant in each regression 1-5. The regression 1 results show that the coefficients on the income levels of both parents are positive and the coefficient values increase with the increase in the parental income level, indicating the following: 1. Parents having a high income plays a positive role in improving the income levels of their children. 2. The higher the parents' income levels are, the greater the probability of their children earning a high income at work. Regression 2 adds family social status to the model (the father's occupation type is the proxy variable). The original income level coefficients for both parents are still significant, and with the improvement of the family's social status, the probability of their children earning a high income also increases. The results from regression 3 show that compared with the offspring born before China's opening but after the founding of New China, offspring born after China's opening have a higher income. The probability of being high income has increased significantly; in addition, the probability of being high income for offspring born before the founding of New China is greatly reduced compared to that of those born after the founding of New China. The results of regression 4 can be seen: compared to those who live in rural areas, the chances of children who live in urban areas earning a higher level of income have greatly increased.

Finally, after removing the control variable for the individual's personal effort in regression 5, the following can be seen: 1. The coefficient on gender has changed from insignificant to significant at the 5% level, which shows that gender can affect the probability of children earning a high income but that they can compensate for the effects of gender to a certain extent through their own efforts. 2. After removing the variable for individual effort, the impact of parental income levels on children's income significantly decreased, which indicates that the income level of parents is still an important factor in determining the child's income level, even after controlling for the child's personal effort.3. Although the mother's income level is lower than that of the father, the mother's influence on the probability of her offspring earning a high income is always greater than the influence of fathers who earn a similar income. This shows that strengthening care for women and improving the quality of women's employment and income can positively affect not only the women themselves but also the accumulation of human capital for future generations. 4. The degree of inequality in income opportunities is higher for women than for men, higher in cities than in rural areas, and higher for groups born after China's opening than for those born before it. This shows that women as a whole are still at a disadvantage in terms of income. Compared with those living in rural areas, those living in cities have a higher probability of obtaining high incomes, but the phenomenon of intergenerational solidification in urban income is more prevalent and intergenerational income inequality in urban areas has also increased.

Table 5. Marginal effects of explanatory variables based on regression 4.

Explanatory variables	Low income	Middle income	Upper-middle income	High income
Father is middle income	−0.1889***	−0.0791 ***	0.1719***	0.0962 ***
	(0.0054)	(0.0042)	(0.0048)	(0.0063)
Father is upper-middle income	−0.2424**	−0.1937**	0.2292***	0.2069 ***
	(0.0056)	(0.0049)	(0.0049)	(0.0073)
Father is high income	−0.2776***	−0.3515***	0.1903 ***	0.4382 ***
	(0.0049)	(0.124)	(0.0104)	(0.0273)
Mother is middle income	−0.1539***	−0.1374**	0.1688 ***	0.1217 ***
	(0.0058)	(0.0070)	(0.0063)	(0.0083)
Mother is upper-middle income	−0.1980 ***	−0.2804 ***	0.1966***	0.2816 ***
	(0.0074)	(0.0104)	(0.0038)	(0.0147)
Mother is high income	−0.2960***	−0.3787**	0.1357 ***	0.4590***
	(0.0084)	(0.0185)	(0.0222)	(0.0427)
Father's occupation is industrial or tertiary-industry manual labor	−0.0341***	−0.0141**	0.0308***	0.0164 ***
	(0.0054)	(0.0024)	(0.0041)	(0.0037)
Father's occupation is general nonmanual labor	−0.0552***	−0.0271***	0.0528***	0.0295 ***
	(0.0093)	(0.0070)	(0.0114)	(0.0060)
Father's occupation is high-level nonmanual labor	−0.0709 ***	−0.0426**	−0.0708 ***	0.0414 ***
	(0.0085)	(0.0058)	(0.0212)	(0.0057)
Female offspring	−0.0004	−0.0004	−0.0008	−0.0002
	(0.0074)	(0.014)	(0.0064)	(0.0017)
Children born in 1930-1949	0.1936***	−0.0305*	−0.1085***	−0.0545 ***
	(0.0417)	(0.0022)	(0.0752)	(0.0073)
Children born in 1980-1995	−0.0304***	−0.0124***	0.0263***	0.0166 ***
	(0.0047)	(0.0022)	(0.0074)	(0.0038)
Offspring living in the city	−0.0627 ***	−0.0223 ***	0.0547***	0.0324 ***
	(0.0038)	(0.0024)	(0.0043)	(0.0029)
Effort of offspring	−0.0650***	−0.0231***	0.0546**	0.0335 ***
	(0.0028)	(0.0017)	(0.0027)	(0.0007)

Note: *, **, *** mean significant at the 10%, 5%, and 1% significance level respectively. The standard deviation is in parentheses below.
Source: The Authors.

5.1. Robustness tests

To test the robustness of the results, the samples were re-categorized. Since people who started working before the age of 16 often did not receive a college education, there is a high probability that such people have a lower socioeconomic status and therefore may have stronger intergenerational income transmission. Therefore, the age of the offspring was re-categorized to account for the actual educational situation of the Chinese population. The sample was divided into two age groups, 16-23 and 23-55, and the income level of the offspring was used as the explained variable. In the estimation result, the coefficients of each variable in the model are significant, indicating that the rank-ordered probit estimation result is robust.

6. Marginal Effects Analysis

6.1. Results

Because the coefficients directly derived from the ordered probit model are difficult to interpret, this paper further explores the influence of parents' income levels on children's income levels by calculating the average marginal effect of each explanatory variable on the income level of the offspring based on regression 4. The results are shown in Table 5.

7. Discussion

First, the turning point in the marginal influence of parents on the income levels of their offspring occurs among parents who are at the middle-income level or above. The results show that when the parents are medium income or above, the probability of their children earning a high income increases significantly. When the father is middle income, the probability of his children receiving a high income is 9.62% higher than the average. In the case of a father with a high income, the probability of his children earning a high income is significantly increased to 20.69% above average. The marginal impact of the mother's income level on the probability of her children earning a low income is significantly lower than the average. For example, when the father and mother are both high income, the probability of their children receiving only a low income is significantly reduced by 27.76% and 29.60%, respectively, while the probability of children receiving high income increases significantly, by 43.82% and 45.90%, compared to the average. Second, the higher the income level of parents is, the greater the marginal impact on their children's income, and the impact of maternal income on the income of their children is greater than that of paternal income. For example, when the father's income level is middle, upper middle, or high, the probability of his children earning a high income increases by 9.62%, 20.69, and 43.82%, respectively; when the mother's income level is middle, upper middle, or high, the probability of her children earning a high income increases by 12.17%, 28.16% and 45.90%, respectively, above the average. The impact of the social status of the family, as represented by the occupational category of the father, on the probability that the offspring earns a high income is also significant. If the father is engaged in high-level nonmanual labor, the probability of the offspring earning a high income is greater than the average by 4.14%. Similarly, the probability of earning a high income increases by 3.24% compared to the average for children living in cities. Finally, The probability that offspring born before the founding of the People's Republic of China earn a high income decreases by 5.45% compared with the average, while the probability that offspring born after China's opening earn a high income increases by 1.66% compared with the average. The main reason for this result is that the rapid development of the Chinese economy since China's opening has increased individual incomes.

7.1. Hypothetical test

Table 6 reports the LR test statistics of each coefficient in Table 5. It can be seen that at the 10% significance level, each coefficient is significant.

8. Further discussion

8.1. Intergenerational transmission mechanism of income: children's education

Parents improve their ability to obtain high income through human capital investment such as education for their children, and realize income transmission based on human capital transmission. However, after the implementation of nine-year compulsory education in China, there should be no difference in quantity except for the

Table 6. Hypothesis test result.

Explanatory variables	Low income	Middle income	Upper-middle income	High income
Father is middle income	14.27***	18.26**	15.49***	11.49***
Father is upper-middle income	17.68**	16.28*	15.82**	16.48***
Father is high income	15.28**	14.84**	16.28***	17.82**
Mother is middle income	10.82**	16.28**	10.68***	16.52*
Mother is upper-middle income	12.68**	14.58***	14.59**	17.68**
Mother is high income	15.16***	12.64**	15.67**	10.26**
Father's occupation is industrial or tertiary-industry manual labor	18.26**	18.26***	15.67***	15.06**
Father's occupation is general nonmanual labor	17.56***	15.26**	15.29**	14.50**
Father's occupation is high-level nonmanual labor	15.67***	18.02***	18.46**	18.62**
Female offspring	10.28**	16.08***	15.28**	14.49**
Children born in 1930-1949	16.27**	12.08*	17.28***	16.28**
Children born in 1980-1995	17.68*	14.65***	10.68**	15.72***
Offspring living in the city	16.28**	16.28**	9.49**	16.58**
Effort of offspring	15.26**	14.49***	8.26**	15.82**

Note: *, **, *** mean significant at the 10%, 5%, and 1% significance level respectively.
Source: The Authors.

Table 7. Ways to influence children's education.

	Father	Mother
Constant term	12.21	11.49
Income	0.14**	0.21**
	(0.155)	(0.741)
Years of education	0.15***	0.22***
	(0.556)	(0.648)
SE	1.491	1.515

Note: *, **, *** mean significant at the 10%, 5%, and 1% significance level respectively. The standard deviation is in parentheses below.
Source: The Authors.

difference in education quality. In other words, changes in family income are likely to be insensitive to children's education, and parents' individual characteristics and job characteristics may be important factors driving children's education. Therefore, whether parents influence their children's education through income, their own education, family and other factors needs to be further tested. For this reason, the children's years of education should be used as the explanatory variable, and the parents' income, education and other individual characteristics and job characteristics should be used as explanatory variables for regression analysis. The regression equation is as follows:

$$E_s = \alpha + \beta y_i + \lambda E_i + \eta_j \sum D_{ij} + \mu$$

E_s is the education years of the child, y_i is the income of the parents (father is y_m, mother is y_f), E_i is the parents (mother is E_m and father is E_m) years of education, and D_{ij} is many control variables consistent with the above. The results are shown in Table 7:

Among them, the parent's education years is the most important factor in determining the children's education years, and the mother's education years have a significantly higher impact on the children's education years than the father. Each increase in the mother's education years will increase the children's education years by 0. For 25 years (both income samples) and 0.22 years (both on-job samples), the father's influence was

0.117 years (both income samples) and 0.18 years (both on-job samples). It can be seen that the education level of the children in the family is more affected by the mother than the father. This may be mainly because the mother plays a more important role in the family, so the education level of the mother will affect the education of the children.

9. Conclusions and suggestions

9.1. General conclusion

This article aims to examine the evolutionary characteristics of the intergenerational transmission of income and income inequality in China against the backdrop of China's rapid economic development since its reform and opening, which has been characterized by serious wealth polarization and little intergenerational income mobility. The mechanism by which family background, especially the income of the parents, affects the intergenerational transmission of income is revealed. To this end, using a rank-ordered probit estimation model and data from the 10 China Health and Nutrition Surveys from 1989 to 2015 that focuses on the parental income, the effect of family background on the intergenerational transmission of income was investigated. The research conclusions are as follows:

1. Parental income level is an important factor that affects the income level of offspring. The higher the parents' income is, the greater the probability that their offspring will obtain a high income. After controlling for the child's personal effort, the impact is still significant and even strengthened. This shows that to a certain extent, the efforts of the offspring significantly strengthen the direct influence of parental income on the offspring's income.
2. The turning point in the marginal impact of parental income on their children's income level occurs among parents who earn a middle income or above. The probability of their offspring obtaining a high income increases significantly, while the probability of staying in the low-income range decreases significantly.
3. Although the mother's income level is lower than that of the father, the mother's influence on the probability of her offspring earning a high income is always greater than the influence of fathers who earn a similar income. This shows that strengthening care for women and improving the quality of women's employment and income can positively affect not only the women themselves but also the accumulation of human capital for future generations.
4. The degree of inequality in income opportunities is higher for women than for men, higher in cities than in rural areas, and higher for groups born after China's opening than for those born before it. This shows that women as a whole are still at a disadvantage in terms of income. Compared with those living in rural areas, those living in cities have a higher probability of obtaining high incomes, but the phenomenon of intergenerational solidification in urban income is more prevalent and intergenerational income inequality in urban areas has also increased.

5. The intergenerational transmission of income is persistent; the influence of parental income on the income of the offspring is much greater than that of grandparents' income.

9.2. Suggestions

China is still the world's largest developing country. Research has shown that although China's overall poverty level is declining year by year, opportunities for the intergenerational transmission of poverty are on the rise, especially in the less-developed areas in the central and western regions, and the probability of childhood poverty in rural areas is higher than that in the city. Based on the above analysis, this article recommends the following: First, the government should further increase public expenditures on and adopt multiple strategies to increase access to public resources such as health care and education, focusing particularly on those earning low incomes and living in rural areas. The government should ensure that women in remote rural areas obtain sufficient education and public health resources. Second, we must continue to reform the market economy system and to eliminate labor market segmentation and labor mobility barriers between urban and rural areas, as well as occupational segregation and industry monopolies.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Ethical approval

This article does not contain any studies with human participants performed by any of the authors.

Funding

This study was funded by Alibaba Network Technology Co., Ltd (grant number BD20190449X).

Data availability statement

The data that supports the findings of this study are available in the supplementary material of this article

References

Aaberge, R., Bjorklund, A., Jantti, M., Palme, M., Pedersen, P. J., Smith, N., & Wennemo, T. (2002). Income inequality and income mobility in the Scandinavian countries compared to the United States. *Review of Income and Wealth*, *48*(4), 443–469. https://doi.org/10.1111/1475-4991.00063

Atkinson, A. B. (1980). On intergenerational income mobility in Britain. *Journal of Post Keynesian Economics*, *3*(2), 194–218. https://doi.org/10.1080/01603477.1980.11489214

Atkinson, A. B., Trinder, C. G., & Maynard, A. K. (1978). Evidence on intergenerational income mobility in Britain. *Economics Letters*, *1*(4), 383–388. https://doi.org/10.1016/0165-1765(78)90017-4

Becker, G. S., & Tomes, N. (1979). An equilibrium theory of the distribution of income and intergenerational mobility. *Journal of Political Economy*, *87*(6), 1153–1189. https://doi.org/10.1086/260831

Becker, G. S., Murphy, K. M., & Tamura, R. (1990). Human Capital, Fertility, and Economic Growth. *Journal of Political Economy*, *98*(5, Part 2), S12–S37. Part 2), https://doi.org/10.1086/261723

Berger, L. M. (2005). Income, family characteristics, and physical violence toward children. *Child Abuse & Neglect*, *29*(2), 107–133. https://doi.org/10.1016/j.chiabu.2004.02.006

Black, S. E., & Devereux, P. J. (2010). Recent developments in intergenerational mobility. NBER Working Paper No. 15889. *Cepr Discussion Papers*, *4*(1), 1487–1541.

Blalock, H. M., Blau, P. M., Duncan, O. D., & Tyree, A. (1968). The American occupational structure. *American Sociological Review*, *33*(2), 296. https://doi.org/10.2307/2092399

Blanden, J. (2005). Love and money: Intergenerational mobility and marital matching on parental income. Analytical Studies Branch Research Paper Series.

Blanden, Jo, Gregg, P., & Macmillan, L. (2006). Explaining intergenerational income persistence: Non-cognitive skills, ability and education. *Centre for Market & Public Organisation*, *117*(519), C43–C60.

Chakraborty, S. (2004). Endogenous lifetime and economic growth. *Journal of Economic Theory*, *116*(1), 119–137. https://doi.org/10.1016/j.jet.2003.07.005

Chevalier, A., & Lanot, G. (2002). The relative effect of family characteristics and financial situation on educational achievement. *Education Economics*, *10*(2), 165–181. https://doi.org/10.1080/09645290210126904

Chul-InLee, G., S. (2009). Trends in Intergenerational Income Mobility. *Review of Economics & Statistics*.

Erikson, R., & Goldthorpe, J. H. (2002). Intergenerational inequality: A sociological perspective. *Journal of Economic Perspectives*, *16*(3), 31–44. https://doi.org/10.1257/089533002760278695

Fan, C. S. (2003). Human capital, study effort, and persistent income inequality. *Review of Development Economics*, *7*(2), 311–326. https://doi.org/10.1111/1467-9361.00193

Fernandez, R., & Rogerson, R. (1996). Income distribution, communities, and the quality of public education. *The Quarterly Journal of Economics*, *111*(1), 135–164. https://doi.org/10.2307/2946660

Ferreira, F. H. G., & Gignoux, J. (2014). The measurement of educational inequality: Achievement and opportunity. *Policy Research Working Paper*, *28*(2), 210–246.

Ferreira, S. G., & Veloso, F. A. (2006). Intergenerational mobility of wages in Brazil. *Brazilian Review of Econometrics*, *26*(2), 181–211. https://doi.org/10.12660/bre.v26n22006.1576

Ferrer-I-Carbonell, A., & Gowdy, J. M. (2007). Environmental degradation and happiness. *Ecological Economics*, *60*(3), 509–516. https://doi.org/10.1016/j.ecolecon.2005.12.005

Gershanovich, E. A. (2004). Investment in education: measuring private and public returns. *Science and Technology, 2004. KORUS 2004. Proceedings. International Symposium On The 8th Russian-Korean*.

Ichino, A., Karabarbounis, L., Moretti, E. ((2010).). The political economy of intergenerational income mobility. *NBER Working Papers*.

Jo, B., Paul, G., & Lindsey, M. (2007). Accounting for Intergenerational Income Persistence: Noncognitive Skills, Ability and Education. *The Economic Journal*, *519*, 43.

Kan, K., Li, I. H., & Wang, R. H. (2015). Regression toward mediocrity in economic stature. *B.E. Journal of Economic Analysis & Policy*, *82*(3), 409–429.

Kremer, M. (1997). How much does sorting increase inequality? *The Quarterly Journal of Economics*, *112*(1), 115–139. https://doi.org/10.1162/003355397555145

Lauer, C. ((2003).). Education and unemployment: A French-German comparison. *ZEW Discussion Papers*.

Louw, M., Berg, S., Van Der., & Yu, D. (2007). Convergence of a kind: Educational attainment and intergenerational social mobility in South Africa. *South African Journal of Economics*, *22*(2), 1149–1162.

Mazumder, B. (2001). WP 2001-18 earnings mobility in the US: A new look at intergenerational inequality. *SSRN Electronic Journal*, *14*(1), 749–768.
Mazumder, B. (2005). Fortunate sons: New estimates of intergenerational mobility in the United States using social security earnings data. *The Review of Economics and Stats*, *87, 1297–1303.*
Nicoletti, C., & Ermisch, J., F. (2007). Intergenerational earnings mobility: Changes across cohorts in Britain. *B.e.Journal of Economic Analysis & Policy Contributions to Economic Analysis & Policy*, *7*(2), 577–594.
Oded, G., & Joseph, Z. (1993). Income distribution and macroeconomics. *Review of Economic Studies*, *1*, 35–52.
Pekkala, S., & Lucas, R. E. B. (2007). Differences across cohorts in Finnish intergenerational income mobility. *Industrial Relations A Relations*, *46*(1), 81–111. https://doi.org/10.1111/j.1468-232X.2007.00458.x
Lopreato, J. (1965). Social mobility in Italy. *American Journal of Sociology*, *71*(3), 311–314. https://doi.org/10.1086/224090
Tomes, B. N. (1986). Part 2: The family and the distribution of economic rewards || human capital and the rise and fall of families. *Journal of Labor Economics*, *4*(3), S1–S39.
Tsiddon, G. D. (1997). Technological progress, mobility, and economic growth. *American Economic Review*, *87*(3), 363–382.
Valbuena, J. (2011). Family background, gender and cohort effects on schooling decisions. *Studies in Economics*, *6*(2), 499–526.
Verbeke, W., & Ward, R. W. (2006). Consumer interest in information cues denoting quality, traceability and origin: An application of ordered probit models to beef labels. *Food Quality & Preference*, *17*(6), 453–467.

Appendix

1. Models and Assumptions

Probit model is often used to describe the situation where the explained variable is a discrete variable. In actual economic activities, an economy often faces more than two choices, and these choices have a certain degree of progressive relationship or a certain order, then the rank-ordered probit model can be used to analyze related problems. The earlier use of rank-ordered probit model appeared in the research of (Berger, 2005; Ferrer-I-Carbonell & Gowdy, 2007; Verbeke & Ward, 2006) et al. The Probit model is a generalized linear model that obeys the normal distribution. At present, it is difficult to obtain continuous statistical data in the survey of personal income of Chinese residents. The data in this article are mainly classified as discrete data, so it is an ideal estimation method to analyze the discrete choice problem using the rank-ordered probit model. Using the rank-ordered probit model to process multi-category discrete data is a widely used method in recent years. Since the dependent variable involves four types of discrete values, the rank-ordered probit model should be used in the research process. The rank-ordered probit model is a restricted dependent variable model. Y_{i} is used to represent the ordered response of values (0, 1, 2, …, n). The ordered Probit model of Y_{i} can be expressed by the following formula:

$$Y_i* = \beta \boldsymbol{x_i}' + \varepsilon_i, i = 1, 2, 3, \ldots, n$$

$$Y_i = \begin{cases} 0, & Y_i * \alpha_1 \\ 1, & \alpha_1 < Y_i * \alpha_2 \\ n & \text{if } Yi > \alpha_n \end{cases}$$

The probabilities of $Y_i = 0, 1, 2 \cdots, \mathrm{n}$ are:

$$Prob\left(Y_i = 0 | X_i'\right) = \mathrm{Prob}\left(\beta x_i' + \varepsilon_i 1 | X_i'\right) = \partial\left(\alpha_1 - \beta x_i'\right)$$

$$Prob(Y_i = 1 \jmath X_i') = \text{Prob}(1 < \beta x_i' + \varepsilon_i 2 |\ X_i') = \eth(\alpha_2 - \beta x_i') - \eth(\alpha_1 - \beta x_i')$$

$$\begin{matrix} g \\ g \\ g \end{matrix}$$

$$Prob(Y_i = \text{n} | X_i') = \text{Prob}(n < \beta x_i' + \varepsilon_i |\ X_i') = 1 - \eth(\alpha_n - \beta x_i')$$

Among them, Y_i* is a latent variable whose specific value cannot be observed, but Y is an observable variable; is a set of observed values of explanatory variables, i (i = 1, 2, …, n) represents the number of observations; β represents The parameter variable to be estimated; ε_i is a random explanatory variable; α is the dividing point of the interval; ∂() is the standard normal cumulative distribution function.

With respect to the intergenerational income mobility of Chinese households, this paper has the following assumptions:

Assumption 1: The current pattern of intergenerational income mobility in China mainly reflects inheritance, i.e., the income of the offspring exhibits the same hierarchy as that of the parents. Due to the influence of innate endowment, social security system, public service management and China's unique household registration system, the inequality in the whole society has been exacerbated, resulting in a serious tendency of social stratification in China, so that the intergenerational income shows obvious characteristics of inheritance.

Assumption 2: There is an important effect of wealth held by households on intergenerational income mobility. Household wealth, as a stock of income, not only affects the income of the same generation to a certain extent, but higher household wealth also improves the ability of the next generation to earn income. At the same time, an increase in the income level of the offspring in turn affects the further accumulation of the household wealth stock. In that way, household wealth inevitably leads to changes in the level of intergenerational income mobility.

In this paper, income is defined as a continuous value where each individual achieves his or her desired maximum income $I_j, j \in \{1 \cdots J\}$。 within various constraints such as education, family background, work, and opportunity.

Assumption 3: Maximum income increases with the number of hours you work. Expectations of maximum income are unobservable; all that can be observed is the individual's actual incomeI_j.Real utility is defined as the difference between the actual utility of obtaining the maximum income and the actual cost to the individual in the process of acquisition. For an individual, the optimal income decision is determined by the following equation.

$$\text{Max}_{j \in \{1 \cdots J\}} r(I_j | x) - c(I_j | x)$$

where r() represents the expected benefits, c() represents the expected costs, and the difference between the two equations is the optimal revenue decision.

a. **Assumption 3a:** the function r() > 0, which is strictly monotonically increasing, is a concave function.
b. **Assumption 3b:** The function c()>0, which is strictly monotonically increasing, is a convex function.

This assumption is made to ensure that at the lowest income level, the expected net income is positive as well as a concave function. The benefits and costs, which may be different for different individuals due to a number of observable and unobservable factors, are decomposed in this paper as follows:

$$r(E_j|x) = r(E_j)\varphi_r(x)\varepsilon_r; \quad c(E_j|x) = c(E_j)\varphi_c(x)\varepsilon_c$$

where φ_r and φ_c are positive functions that represent the effects of observable variables on expected benefits and expected costs, respectively. ε_r andε_c represent the effect of unobservable individual heterogeneity on expected benefits and expected costs, respectively, both of which are random variables.

Assumption 4: $E(\varepsilon_r) = E(\varepsilon_c) = 1$

That is, on average, unobservable heterogeneity has a neutral effect on both expected benefits and costs. The probability of an individual with an income level selection can be expressed as follows:

$$\Pr(E_j|x) = \Pr\left[\frac{c(I_j)-c(I_{j-1})}{r(I_j)-r(I_{j-1})}\cdot\frac{1}{\varphi(x)} < \varepsilon\frac{c(I_{j+1})-c(I_j)}{r(I_{j+1})-r(I_j)}\cdot\frac{1}{\varphi(x)}\right]$$

supposed: $\mu_j = \ln\left(\frac{c(I_{j+1})-c(I_j)}{r(I_{j+1})-r(I_j)}\right), \gamma_j = \mu_j\cdot\frac{1}{\varphi(x)}$

Assumption 5: $\ln\varepsilon \sim N(0,\sigma^2)$

Then the above formula can be reduced to $\Pr(I_j|x) = \Phi\left(\frac{\mu_j-\beta x}{\sigma}\right)-\Phi\left(\frac{\mu_{j-1}-\beta x}{\sigma}\right)$

This expression takes the approach of a rank-ordered Probit model, where μ represents the threshold value and the model can be estimated by a maximum likelihood method, thus creating a Probit rank-ordered option model of an individual's choice on expected optimal income.