Intergenerational Income Mobility in China and Underlying Mechanism

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Abstract: *Based on ten rounds of CHNS data from 1989 to 2015, this paper employed dual measurement indicators of the intergenerational elasticity (IGE) of earnings and the income rank association (IRA) coefficient to measure intergenerational income mobility in China. Our findings suggest that China's intergenerational income mobility was relatively stable from 1991-2004 and started to increase after 2004. Our study based on income grouping found that the intergenerational income immobility decreased after 2004 for all income groups; however, the high-income and low-income groups were far more immobile than other income groups; the middle-income group served as a key driver of the relatively high intergenerational income mobility in China. Furthermore, we investigated China's intergenerational income transmission mechanism with a human capital analysis framework. We found that fathers' non-education factors played a dominant role in intergenerational income transmission; under the effects of the social institutional environment, the non-education transmission mechanism started to diminish after 2004, significantly contributing to intergenerational income mobility.*

Keywords: *Intergenerational income mobility, opportunity inequality, urbanization, the expansion of higher education*

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1. Introduction

Since the reform and opening up program was launched in 1978, China has achieved remarkable economic and social development progress. However, household income gaps remain significant between China's urban and rural areas, across regions, and between different social groups; therefore, significant development imbalances still exist. Intergenerational income mobility refers to a change in children's income relative to their parent's income and reflects a change in a family's intergenerational socio-economic status. Therefore, income mobility is a key indicator of equal access to opportunity (Zhang and Eriksson, 2010). Equal opportunity gives people limitless possibilities, promotes human capital accumulation, and inspires potentials for innovative development. Krueger's (2012) research suggests that relatively low intergenerational income mobility is closely correlated with income inequality. Income inequality not only impedes human capital accumulation and harms economic growth efficiency but may also breed social instability. Therefore, increasing intergenerational income mobility is of great importance to raising human capital efficiency, avoiding the middle-income trap, and maintaining social stability (Liu *et al*., 2018).

Existing studies on intergenerational income mobility have been carried out using the following approach: Scholars searched for appropriate methods and indicators to estimate intergenerational

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income mobility as the first step of their research (Nicoletti and Ermisch, 2007; Dahl and DeLeire, 2008), then they discussed the trend of changing intergenerational mobility from vertical and horizontal perspectives of comparison (Yuan, 2017; Blanden, 2013; Narayan *et al*., 2018), and finally explored various determinants of intergenerational mobility (Wu, 2007; Sun, 2012; Yang and Lian, 2015). Based on different data and estimation methods, studies on China's changing intergenerational income mobility have arrived at inconsistent conclusions: Some scholars believed that China's intergenerational income mobility was too low, resulting in severe class immobility (Gong *et al*., 2012; Yuan, 2017); other scholars considered China's intergenerational income mobility is high and continuously rising over recent years (He and Huang, 2013; Lyu and Li, 2017). Regarding the inconsistent estimation results of intergenerational income mobility from the existing studies, this paper employs dual measurement indicators and two estimation methods for a multi-perspective discussion of changing intergenerational income mobility in China. With different indicators and methods, we have reached relatively consistent conclusions: China's intergenerational income mobility was generally stable from 1991 to 2004; however, it started to increase after 2004. Furthermore, classifying the samples of various years into five income brackets in order to create an intergenerational income transmission matrix, we have found that despite decreasing intergenerational income mobility, the high-income and low-income groups were far more immobile than the middle-income group. That is to say, the middle-income group[1] has served as a key driver of high-income mobility in China.

Moreover, we further investigated the change in China's intergenerational income transmission mechanism using a human capital analysis framework and found that fathers' non-education factors played a dominant role in intergenerational income transmission. The decomposed results of various years suggest that the non-education transmission mechanism accounted for more than 60% of the intergenerational elasticity (IGE) of earnings. In terms of absolute values, the effect of the father's non-education factors on the IGE started to diminish. Judging by the impact of the education factor, the impact of fathers' education factor on the IGE experienced an upward trend from 2004 to 2009 primarily because the college enrolment expansion policy implemented since 1999 had reduced intergenerational education mobility, and return on fathers' education was smaller than the return on the children's education, weakening intergenerational income transmission.

Compared with existing studies, this paper has the following innovations: First, dual measurement indicators are employed to conduct a brand-new estimation of China's intergenerational income mobility during a relatively long period. Based on ten rounds of CHNS data from 1989 to 2015, we have employed the IGE indicator and the IRA coefficient (rank-rank slope) to estimate the trend of China's changing intergenerational income mobility in three decades from a dynamic intertemporal perspective; second, from an income grouping perspective, this paper investigates the trend of changing intergenerational income mobility for different income groups; and third, based on the analytical framework of human capital, the evolving intergenerational income transmission mechanism is analyzed from a vertical comparison perspective.

2. Literature Review

2.1 Measurement of Intergenerational Income Mobility

Based on a human capital transmission perspective, Becker and Tomes (1979) created the earliest theoretical framework for measuring intergenerational income mobility and pointed out that the permanent incomes of parents and children should be used in calculating the IGE. When selecting parents' income in a given year as the proxy of such permanent income, the estimated results will be

[1] The "middle-income group" in this paper primarily includes the middle-income and medium-high income groups.

affected by lifecycle bias and transitory shocks, causing the IGE to be underestimated (Solon, 1992). Based on long-term US panel tracking data, Solon (1992) employed two strategies to estimate the IGE. By continuously tracking parents' income level, the first method employed the Ordinary Least Square (OLS) to calculate the IGE; with parents' permanent income as an endogenous variable and parents' level of education as the instrumental variable of permanent income, the second method employed a two-stage instrumental variable (TSIV) method to estimate the IGE. According to Haider and Solon (2006), an individual's income in his/her early 30s and 40s is the closest to his/her average lifelong income, a father's income closest to his permanent income is earned at the age of around 40 years, and the most appropriate range of his child's age is 20 to 30 years.

In real-world survey data, permanent income is hard to be found, and the relationship between a father's and his child's incomes could be non-linear. Recently, some researchers have started to use new indicators for measuring intergenerational income mobility. Dahl and DeLeire (2008) suggested using the parent-child income rank association (IRA) coefficient to depict the income relationship between parents and children, i.e. the coefficient of correlation between children's income rank and parents' income rank. Compared with the permanent income indicator, the IRA can be employed for an intergenerational mobility estimation only with the income rank information of the parents and children to avoid the impact of measurement errors of permanent income on the estimated results of the IGE. Chetty *et al*. (2014) found a robust linear relationship between children's income rank in their birth cohort and father's income rank in his birth cohort. According to US empirical data, a 10% increase of a father's income rank in his birth cohort would lead to a 3.41% increase of his child's income rank in his/her birth cohort.

2.2 China's Intergenerational Mobility and Trends

With improving methods for measuring intergenerational income mobility, many scholars have started investigating China's intergenerational mobility and trends based on China's micro survey data. However, existing studies based on different estimation methods have arrived at disparate intergenerational income elasticities and trends.

Some academics consider intergenerational income mobility in China to be low, resulting in severe class immobility. Based on the urban household education and employment (UHEE2004) data of the National Bureau of Statistics (NBS) for 2004, Gong *et al.* (2012) employed the instrumental variable (IV) method to estimate China's urban household IGE to be 0.63 for 2004, i.e. the income of children in Chinese households was largely dependent on the income of their fathers. Based on the IV method using CHNS data ranging from 1989-2009, Yuan (2017) estimated China's IGE to be in the range of 0.5 and 0.6, suggesting that intergenerational income mobility in China is smaller than in most developed countries. Other academics consider intergenerational income mobility in China to be high and continuously rising. Based on an optimized estimation method using the CHNS1989-2009 data, He and Huang (2013) estimated the IGE to be decreasing; thus, reaching 0.66 in 2000, 0.49 in 2004, 0.35 in 2006, and 0.46 in 2009.

2.3 Intergenerational Income Transmission Mechanism

Judging by existing studies, the intergenerational income transmission mechanism is subject to two factors: First, human capital (Becker and Tomes, 1979; Majumder, 2010; Yang and Qiu, 2016), i.e. the intergenerational transmission of education is of great importance to intergenerational income mobility. Second, natural endowment and upbringing: A natural experiment is carried out to distinguish the causality between genetic endowment and upbringing on intergenerational income transmission (Björklund *et al*., 2016; Liu and Zeng, 2009; Scheeren *et al*., 2017).

Due to the limited publicly available data, we cannot perform a causality test of the intrinsic transmission mechanisms of intergenerational income mobility in China. Extensive research has only

examined the macroscopic and microscopic determinants of intergenerational income mobility (Sun, 2012; Yang, 2016; Zhu *et al.*, 2018). Aside from the causality test, a compromise worth considering is identifying the intrinsic transmission mechanism based on the decomposition of the IGE in the absence of microscopic data. Based on an analytical framework of human capital, Blanden (2013) decomposed intergenerational income mobility into three transmission mechanisms in investigating the relationship between intergenerational education mobility and intergenerational income mobility according to whether or not children's education was determined by parents' education. These transmission mechanisms include: First, through their own education, parents influence their children's education and thus income; second, parents' education may influence children's income through non-education factors such as perceptions and social skills; third, other characteristics of parents (other than education level) - such as better living environment, social capital and education that a father's social status and wealth bring to his child - help improve his child's income level (Narayan *et al*., 2018). This method is applied to the international comparison of intergenerational income mobility to analyze the root cause of differences in intergenerational income mobility across countries. For instance, Blanden (2013) conducted a comparative study of intergenerational income mobility in the US and the UK based on US PSID data and the British Cohort Study (BCS) data of 1970. After decomposing the intergenerational income elasticities of both countries, he found that parent education could explain for about 1/3 of the IGE differences between the two countries.

3. Measurement Method, Data Source and Treatment of Intergenerational Income Mobility

This section explains the indicators for intergenerational income mobility, estimation method and data source, as well as a descriptive analysis of variables.

3.1 Indicators for Intergenerational Mobility and Estimation Method

This paper will employ the intergenerational elasticity of earnings (IGE) and the intergenerational income rank association (IRA) coefficient (rank-rank slope) for measuring the trend of intergenerational income mobility in China. Among them, the IGE is estimated with the OLS and the income smoothening method.

3.1.1 Intergenerational elasticity of earnings (IGE)

Based on Becker and Tomes's (1979) theoretical model, intergenerational income mobility is primarily measured by the elasticity of children's income versus their father's income. Smaller IGE means that children's income is less influenced by their father's income, and that the intergenerational income mobility is higher. Specifically, the father-children intergenerational income transmission can be depicted by equation (1):

$$\ln y_{ci} = \beta_0 + \beta_1 \ln y_{fi} + \varphi X_i + \varepsilon_i \quad (1)$$

Where, $\ln y_{ci}$ and $\ln y_{fi}$ respectively denote the logarithms of the permanent incomes of children and father in household i, and β_1 is the IGE; X is control variables, including age, age squared, father's age and father's age squared; ε_i is the error term of the model. Since father's and children's permanent incomes are hard to obtain from survey data, adopting father's income at a certain time point as the proxy variable will cause the problem of measurement error in the model. The obtained convergence results of the IGE can be ranked as follows according to probability:

$$p\lim \hat{\beta}_1 = \beta_1 \frac{\sigma_f^2}{\sigma_f^2 + \sigma_\varepsilon^2} < \beta_1 \quad (2)$$

σ_f and σ_ε are the variances of the father's permanent income and measurement error, respectively.

With the existence of the measurement error, the IGE obtained with OLS estimation is smaller than the actual value. For this problem, Solon (1992) suggested using the income smoothening method to overcome the model's estimation error. Continuous multi-temporal income data are obtained through a follow-up survey of samples, and the income smoothening method is employed to obtain father's permanent income. The income smoothening method takes the average values of income data of observation samples for more than ten years. After permanent income is substituted with the average income for bias correction, the result of the IGE's convergence in probability becomes:

$$p\lim \hat{\beta}_1 = \beta_1 \frac{\sigma_f^{\ 2}}{\sigma_f^{\ 2} + \sigma_\varepsilon^{\ 2}/T} < \beta_1 \tag{3}$$

The more observation times T, the smaller the estimation bias becomes, but the estimation bias cannot be eliminated. Hence, although the income smoothening method cannot fully eliminate the error of IGE estimation, it can effectively reduce the error estimated with the IGE.

3.1.2 Intergenerational income rank association (IRA) coefficient

Dahl and DeLeire (2008) believed that a father's permanent income may not have a good linear relationship with his child's permanent incomes, but the father's income rank in his birth cohort has a significant linear correlation with his child's income rank in his or her birth cohort. The following model is adopted to depict the relationship between the father's income rank and his child's income rank:

$$Rank_{ci} = \rho_0 + \rho_1 Rank_{fi} + \phi X_i + v_i \tag{4}$$

Where, $Rank_{ci}$ and $Rank_{fi}$ respectively denote the ranks of children and the father of household i in their birth cohorts; ρ_1 is IRA coefficient; X_i is the control variable that is the same with equation (1); v_i is the model's error term.

Although the IRA can overcome such problems as the measurement error of the father's permanent income, it also presents new challenges. Questions include, for instance, whether a person's income rank among his/her birth cohort remains constant. An individual may achieve upward mobility through hard work. Moreover, in depicting the intergenerational income mobility, the IRA coefficient is not as straightforward as the IGE.

3.2 Data, Variables and Descriptive Statistical Analysis

This paper employs the unbalanced panel data of ten rounds of the China Health and Nutrition Survey (CHNS) 1989-2015. The survey years of the data set span nearly 30 years, including 1989, 1991, 1993, 1997, 2000, 2004, 2006, 2009, 2011, and 2015. This survey was jointly conducted by the Carolina Population Center at the University of North Carolina at Chapel Hill, the US National Institute of Nutrition and Food Safety, and the Chinese Center for Disease Control and Prevention (CCDC). This survey employs the multistage cohort somebody method, and selects samples of nine provincial-level regions including Heilongjiang, Liaoning, Henan, Hubei, Hunan, Guizhou, Guangxi, Shandong, and Jiangsu from 1989-2009. The scope of the samples for 2015 has been expanded to 15 provincial-level regions, covering 30,000 individuals from 7,200 households. Since fathers are the breadwinners in most families, this paper only investigates the intergenerational income mobility of children relative to their fathers. To minimize the estimation error, we have limited the children's age between 25 and 35 years in order to use the income of the children in this age group to approximate their permanent income.[2] This paper has processed the sample data as follows:

(1) Match a father with his son or daughter.

[2] Haider and Solon (2006) believed that an individual's income in his/her 30s and 40s is the closest to his/her lifelong average income, and that it is relatively appropriate to use the incomes of these age groups as an individual's permanent income.

Table 1: Key Variables and Descriptive Statistics

Variable	Sample size	Mean value	Standard deviation	Min.	Median	Max.
Children's income (yuan)	3,013	17,464	32,807	0	8,744	832,414
Father's income (yuan)	3,013	14,511	28,217	0	7,456	516,129
Child's age	3,013	28.56	2.940	25	28	35
Child's length of education (year)	3,013	10.47	3.410	0	9	18
Father's age	3,013	56.64	4.630	44	57	65
Father's length of education (year)	3,013	6.950	4.280	0	6	18

(2) Remove samples with missing or abnormal key information such as income, age, and level of education.

(3) Remove samples with children's age below 25 or greater than 35 and father's age above 65 years.

(4) Remove samples with children or fathers who are students.

Finally, we have obtained 3,013 pairs of valid samples, including 190 pairs of samples in 1989, 270 pairs in 1991, 286 pairs in 1993, 356 pairs in 1997, 420 pairs in 2000, 282 pairs in 2004, 243 pairs in 2006, 252 pairs in 2009, 304 pairs in 2011 and 410 pairs in 2015.[3] Descriptive statistics of the variables are shown in Table 1.

In Table 1, income refers to the children's annual income, and the father's income refers to the father's annual income.[4] For both, we adopted the price level of 2015 and adjusted for CPI to make incomes comparable across various years. From 1989-2015, China's average annual income was only 17,464 yuan; however, it was still higher than the father's annual average income of 14,511 yuan. The average age of the child samples is around twenty-eight years, and the father's average age is around 56 years. Compared to the fathers, the children's average income and education have yet to improve.

In estimating the IGE, this paper intends to use the OLS estimation method and income smoothening method. Among them, the income smoothening method takes the average of father's income data in historical years to obtain father's permanent income. We select father's data in historical years from the age of 40 to the age of 50, and father's income data in those years are averaged to obtain father's permanent income. According to the father's age scope, we only estimate the IGE of samples after 2004. For samples of 2004, father's income is the average value of father's incomes in 1989, 1991 and 1993; for samples of 2006, father's income is the average value of father's incomes in 1991, 1993 and 1997; for samples of 2009, father's income is the average value of father's incomes in 1993, 1997 and 2000; for samples of 2011, father's income is the average value of father's incomes in 1997, 2000 and 2004; for samples of 2015, father's income is the average value of father's incomes in 2000, 2004 and 2006. The average value of the fathers' and children's age of the matched samples and the sample size is shown in Table 2.

[3] Compared with He and Huang (2013), this paper employs the same set of data, but the sample size is different. In their choice of father and child samples, they matched fathers with their eldest sons, excluding daughters or younger sons. While this treatment is more in line with international research paradigm on intergenerational income mobility, the resultant sample size is too small, and the accuracy of estimation is substantially smaller. Hence, this paper additionally matches younger sons with their fathers. Given China's reality, there is little difference in the economic status between young women and young men in China, both of whom acquire similar resources from their fathers' socioeconomic status. Hence, this paper also includes daughters into child samples. Without contradicting the intrinsic mechanism of intergenerational income mobility, this may increase sample size to some extent and reduce the estimation error of the intergenerational income elasticity.

[4] Income level refers to gross income level, including wage income and operating income.

Table 2: Mean Value of the Father's and the Children's Age Using the Income Smoothening Method

		2004	2006	2009	2011	2015
Year of children's birth		1969-1979	1971-1981	1974-1984	1976-1986	1980-1990
Average age of children		31	30	30	30	32
Father's average age	1989	45	——	——	——	
	1991	47	41	——	——	——
	1993	49	46	43	——	——
	1997	——	50	47	44	——
	2000	——	——	50	47	44
	2004	——	——	——	51	48
	2006	——	——	——	——	50
Sample size		127	117	125	77	59

Judging by the statistical results of Table 2, the average age of the child samples in the four rounds of survey data is approximately thirty years, which are matched with the fathers' average age of 40 to 50 years. Since the average income of the fathers aged between 40 years and 50 years still underestimates the fathers' lifelong permanent income, the IGE obtained is likely to be underestimated. With fewer than 100 matched sample pairs for 2011 and 2015, the problem of deviation may also exist due to insufficient sample size.[5]

4. Change in Intergenerational Income Mobility: 1989-2015

First, this section investigates changes in intergenerational income mobility from 1989-2015 prior to conducting a study on intergenerational income mobility for different income groups.

4.1 Overall Intergenerational Income Mobility

Based on the dual indicators of IGE and IRA coefficients, we analyzed the change in the intergenerational income mobility in China from 1989 to 2015. Tables 3 and 4 respectively provide the estimated results of IGE based on the OLS estimation and income smoothening methods. Table 5 presents the estimated results of the IRA coefficients.

As shown by the OLS estimation results of IGE over the years in Table 3, the coefficient of the logarithm of the fathers' income is significantly positive at 1%, which explains that the fathers' income has a significant and robust impact on the children's income. From 1989-2015, the IGE was between [0.266, 0.414]. From 1989-2006, IGE is shown to have M-shape volatility, which is similar to Lyu and Li's (2017) findings (see Figure 2). Specifically, China's IGE has remained stable from 1991-2004 and started to decline since 2004. Furthermore, by 2015, IGE had declined by 0.266.

Based on the estimated results of the income smoothening method, Table 4 shows that IGE is significantly positive for 2004, 2006, 2009, and 2011, and the intergenerational income mobility for 2015 is insignificant.[6] Figure 1 reveals a decreasing trend of the IGE estimated with the income smoothening method from 2004-2011. This further indicates the rising intergenerational income mobility in China

[5] Since this paper is concerned with change in intergenerational income mobility rather than the specific estimated value of the IGE in each year, this method is employed to estimate the trend of China's IGE in 2004, which has led to almost identical results. From this perspective, results obtained from the income smoothening method support this paper's conclusions to some extent.

[6] After matching is performed with the income smoothening method, we have obtained 59 samples for 2015, and the estimated results could be insignificant due to limited sample size.

Table 3: IGE Based on the OLS Method, 1989-2015

	Dependent variable: Logarithm of children's income									
	1989	1991	1993	1997	2000	2004	2006	2009	2011	2015
Logarithm of father's income	0.286 ***	0.392 ***	0.414 ***	0.364 ***	0.388 ***	0.404 ***	0.314 ***	0.312 ***	0.315 ***	0.266 ***
	(0.056)	(0.072)	(0.113)	(0.074)	(0.058)	(0.113)	(0.06)	(0.10)	(0.081)	(0.101)
Control variables	Controlled	Controlled	Controlled	Controlled	Controlled	Controlled	Controlled	Controlled	Controlled	Controlled
Sample size	189	264	278	312	394	280	240	252	304	410
R^2	0.175	0.212	0.241	0.084	0.138	0.147	0.129	0.028	0.0996	0.124
R^2_adjusted	0.153	0.197	0.227	0.069	0.127	0.131	0.110	0.009	0.0845	0.113
F value	6.463	9.489	3.086	3.197	9.643	3.138	9.267	1.520	3.038	1.949

Notes: Numbers in parenthesis are robust standard errors; ***, ** and * denote significance at 1%, 5% and 10% levels. The coefficients of reporting age, age squared, father's age, father's age squared, and the coefficient of the constant term are omitted in this paper.

Table 4: IGE Based on the Income Smoothening Method, 2004-2015

	Dependent variable: Logarithm of children's income				
	2004	2006	2009	2011	2015
Logarithm of father's income	0.397*** (0.099)	0.315*** (0.076)	0.255** (0.128)	0.192*** (0.056)	0.328 (0.240)
Control variables	Controlled	Controlled	Controlled	Controlled	Controlled
Sample size	127	117	125	77	59
R^2	0.130	0.145	0.087	0.077	0.206
R^2_adjusted	0.095	0.107	0.049	0.012	0.131
F value	5.318	3.638	1.286	2.772	1.218

after 2004.

The estimated results of IRA coefficient in Table 5 suggest that the coefficient of fathers' income rank is significantly positive, i.e. a child's income rank in their birth cohort is significantly correlated with their father's income rank in his birth cohort. The value range of the IRA coefficient is [0.202, 0.458]. Between 1991 and 2004, there was a slight volatility in the IRA, i.e. intergenerational income mobility was relatively stable in this period and consistent with the IGE. In 2004, the IRA peaked at 0.458, and after 2004, the IRA kept on the decrease, down to 0.202 in 2015 (see Figure 2). That is to say, intergenerational income mobility in China has been on the rise since 2004. This finding is highly consistent with our conclusion on the trend of intergenerational income mobility estimated with the IGE.

4.2 Intergenerational Income Mobility of Different Income Groups

Next, we will discuss the trends and changes of intergenerational mobility of income for households of different income groups. Samples divided into five equal groups according to the father's income percentile. The intergenerational income transmission matrix of income grouping is employed to

[7] The intergenerational income transmission matrix is employed to measure the intergenerational income mobility of various income groups. It measures intergenerational income mobility in the absolute sense. Intergenerational income elasticity or IRA measures intergenerational income mobility in the relative sense.

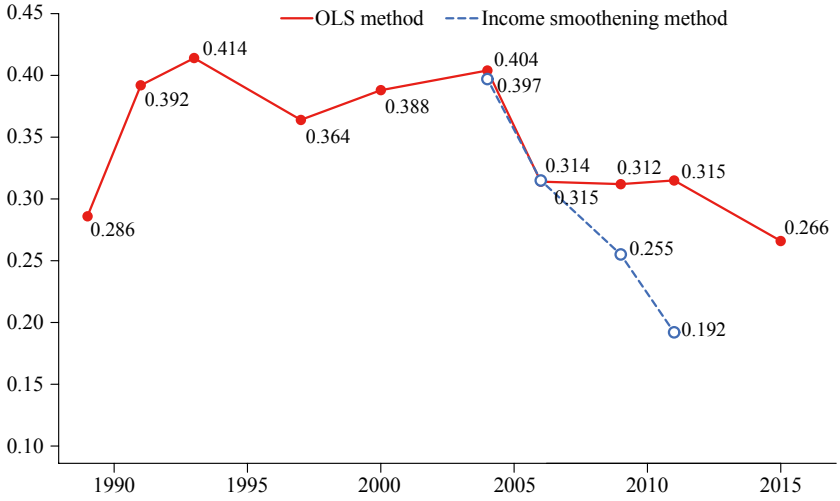

Figure 1: Change in Intergenerational Elasticity of Earnings (IGE), 1989-2015

Table 5: Intergenerational Income Rank Association (IRA) Coefficient, 1989-2015

	Dependent Variable: Rank of Children's Income									
	1989	1991	1993	1997	2000	2004	2006	2009	2011	2015
Father's income rank	0.375 ***	0.444 ***	0.456 ***	0.454 ***	0.408 ***	0.458 ***	0.416 ***	0.295 ***	0.303 ***	0.202 ***
	(0.071)	(0.060)	(0.060)	(0.055)	(0.051)	(0.053)	(0.060)	(0.063)	(0.054)	(0.042)
Control variables	Controlled	Controlled	Controlled	Controlled	Controlled	Controlled	Controlled	Controlled	Controlled	Controlled
Sample size	190	270	286	356	420	282	243	252	304	410
R^2	1337	0.170	0.178	0.178	0.148	0.206	0.166	0.038	0.095	0.059
R^2_adjusted	0.129	0.167	0.176	0.176	0.146	0.203	0.162	0.034	0.092	0.057
F value	28.28	54.61	58.07	68.56	65.25	74.32	48.47	9.562	31.83	23.73

investigate the intergenerational income mobility of households in various income groups.[7] The intergenerational transmission matrix of income grouping is $P=(p_{ij})_{n\times n}$, where p_{ij} means the frequency of a father in income group j and his child in income group i. If both the child and the father are in the same income group, it is deemed that the child has experienced no intergenerational income mobility; if the child is in a higher income group compared with his or her father, it is deemed that the child has experienced upward mobility in his or her intergenerational income; on the contrary, it is deemed that the child has experienced downward mobility in his or her intergenerational income.

From the perspective of income grouping, we mix the CHNS data of 1989-2015 before further describing the trend of income mobility change in various years from an income grouping perspective to create an intergenerational income transmission matrix of full sample income grouping for historical years, as shown in Table 6.

Results in Table 6 suggest a higher probability for children and father to be in the same income group than move to other income groups. For households with low-income and high-income fathers, there is a higher probability for their children to be in the same income group with their fathers. For a low-income father, the probability for his child to be in the low-income group is 47.58%; for a high-income father, the probability for his child to be in the high-income group is 59.85%. That is to say,

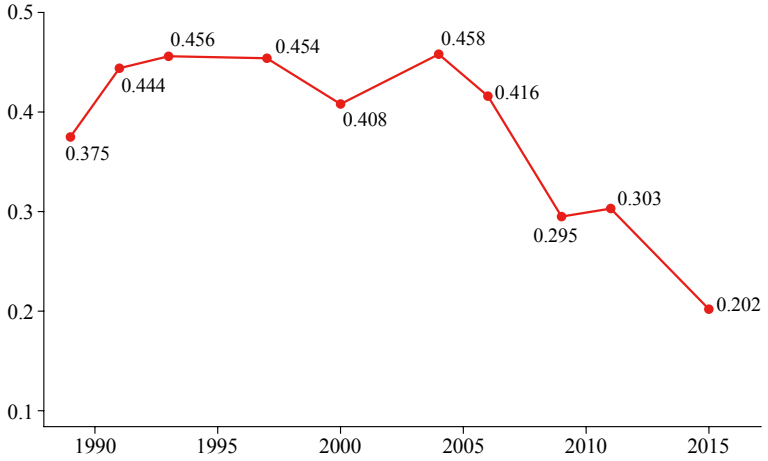

Figure 2: Trend of Intergenerational Income Rank Association (IRA) Coefficient, 1989-2015

Table 6: Intergenerational Transmission Matrix of Income Grouping for Mixed Samples, 1989-2015

		Range of father's income percentiles				
		Low-income group [0,20%)	Medium-low-income group [20%,40%)	Middle-income group [40%,60%)	Medium-high-income group [60%,80%)	High-income group [80%,100%]
Range of children's income percentiles	Low-income group [0,20%)	**1021 (47.58%)**	515 (24.00%)	321 (14.96%)	196 (9.13%)	93 (4.33%)
	Medium-low-income group [20%,40%)	421 (19.62%)	**768 (35.79%)**	598 (27.87%)	283 (13.19%)	76 (3.54%)
	Middle-income group [40%,60%)	318 (14.82%)	464 (21.62%)	**693 (32.29%)**	499 (23.25%)	172 (8.01%)
	Medium-high-income group [60%,80%)	252 (11.78%)	291 (13.60%)	359 (16.78%)	**721 (33.69%)**	517 (24.16%)
	High-income group [80%,100%]	133 (6.18%)	109 (5.07%)	174 (8.09%)	448 (20.82%)	**1288 (59.85%)**

fathers from low-income households are more likely to transmit their adverse income status to their children; fathers from high-income households are more inclined to help their children earn more incomes with their favorable socio-economic status.

The probability for fathers in one income group and children in another income group is used to describe the degree of intergenerational income mobility. A higher probability suggests higher income mobility and lower intergenerational income mobility, and vice versa. Next, we create an intergenerational income transmission matrix for income groups in each survey year from 1989 to 2015, and the results of income immobility for various years are shown in Figure 3.

Figure 3 shows that income immobility was high for the high-income group and the low-income group from 1989 to 2015. For the low-income group intergenerational income immobility was much higher compared with other income groups. The income immobility of the low-income group peaked in 1989 and in 1997 around 50%, i.e. when a father is in the low-income group, his child has a close to 50% chance to also be in the low-income group, and low-income households are very likely to transmit

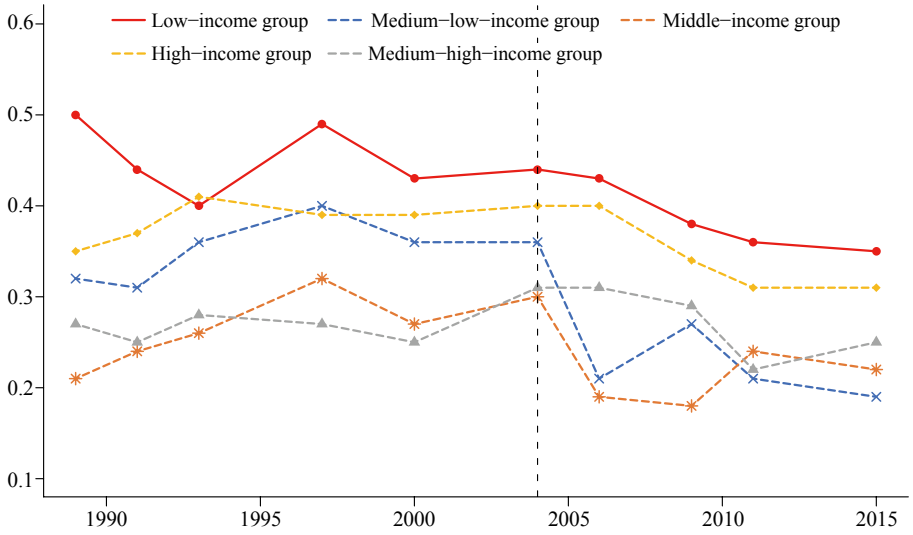

Figure 3: Change in Income Immobility for Various Income Groups, 1989-2015

their adverse economic status to the next generation. Income immobility for the intermediate three income groups is relatively low, especially for the middle- and medium-high-income groups, which comprise the majority of China's middle-income group and serve as key drivers for the relatively high intergenerational income mobility in China. In 2004 and prior, the immobility rates for various income groups except the low-income group increased slowly. Since 2004, the immobility rates for the low-income and high-income groups have been decreasing. The immobility rates have generally decreased for the other three groups; however, they are subject to certain volatility. The middle-income group, in particular, saw their income immobility rate first decrease before increasing at a later stage.

5. Intergenerational Income Transmission Mechanism: An Analytical Framework of Human Capital

Existing studies have found that human capital is a key entry point for discussing the intergenerational income transmission mechanism. Based on a human capital framework, Becker, and Tomes (1979) created a theoretical model for intergenerational income transmission. Based on the analytical framework of human capital, this paper has decomposed the IGE of Chinese households from 1989 to 2015 to analyze the intergenerational income transmission mechanism and its evolving trend.

As a key driver of human capital formation, education is vital to income. Parents' education may influence children's education. Therefore, the intergenerational correlation of education also exists and can be referred to as the intergenerational mobility of education. Based on the traditional analytical framework of the Mincer equation, the relationship between the intergenerational mobility of income and the intergenerational mobility of education can be established under the assumption that the determinants of personal income include education and non-education income (Blanden, 2013), dividing intergenerational income transmission into the following three avenues (as shown in Figure 4) : First, a father influences his child's education through his own education and thus influences his child's income; second, a father's education influences his child's income by influencing his child's non-education factors such as perceptions and social skills; third, a father's other characteristics (non-education factors), i.e. father's abilities, individuality, social status and wealth, for instance, bring about a better living environment, social capital and educational opportunities, raising children's income level (Narayan *et al*., 2018). The first two conduits reflect the impact of a father's education on his child's income, and

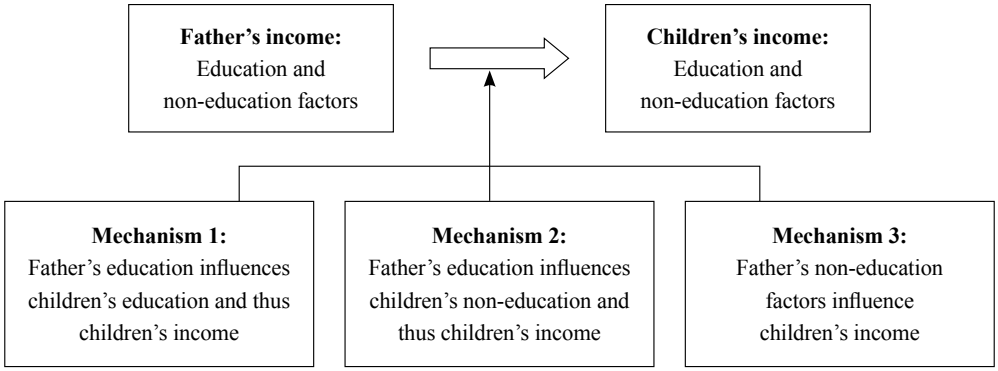

Figure 4: Institutional Analysis of Intergenerational Income Mobility under the Human Capital Framework

the third conduit reflects the impact of a father's non-education factors on his child's income.

Model (1) for intergenerational income mobility can be simplified into equation (5):

$$\ln y_{ci} = \beta_0 + \beta_1 \ln y_{fi} + \varepsilon_i \tag{5}$$

OLS method is adopted to estimate the IGE β_1. Education is measured by the length of a person's education, and IGE is estimated following a similar method. The father-child intergenerational mobility of education model is created as follows:

$$Edu\_year_{ci} = \pi + \varphi_c Edu\_year_{fi} + u_i \tag{6}$$

Where, Edu_year_{ci} and Edu_year_{fi} respectively denote the child's and the father's length of education in household i, φ_c is the intergenerational elasticity of education, and u_i is the model's error term. Assuming that an individual's income in the labor market is jointly determined by education and non-education factors, the income determination equations for a father and his child can be respectively expressed as follows:

$$\ln y_{fi} = \theta_f + \phi_f Edu\_year_{fi} + v_{fi} \tag{7}$$

$$\ln y_{ci} = \theta_c + \phi_c Edu\_year_{ci} + v_{ci} \tag{8}$$

Where, ϕ_f and ϕ_c respectively denote return on education for a father and his child, v_{fi}, v_{ci} includes their non-education factors that may influence income such as personal capabilities, work experience and personal attributes. The goodness of fit for equation (6) R^2 is expressed as $R_{Edf}{}^2$, and the relationships between IGE β_1 and the intergenerational elasticity of education φ_c and between the child's return of education ϕ_c and the father's return on education ϕ_f can be expressed as:

$$\beta_1 = \left(\frac{\phi_c}{\phi_f}\varphi_c\right) \times R_{Edf}{}^2 + \frac{1}{\phi_f} \times \frac{Cov\left(v_{ci}, Ed_{fi}\right)}{Var\left(Ed_{fi}\right)} \times R^2{}_{Edf} + \frac{Cov\left(\ln y_{ci,} v_{fi}\right)}{Var\left(v_{fi}\right)} \times \left(1 - R^2_{Edf}\right) \tag{9}$$

Where, the first term of equation (9) is the intergenerational income mobility effects of the intergenerational education mobility and the child's and the father's returns on education for measuring the first transmission mechanism of intergenerational income mobility; the second term denotes the impact of the father's education on the non-education factors that influence his child's income, depicting the second transmission mechanism of intergenerational income. The third term $\frac{Cov\left(\ln y_{ci,} v_{fi}\right)}{Var\left(v_{fi}\right)}$ is the regression coefficient of the child's income and factors (non-educational factors) that influence the father's income, depicting the third intergenerational income transmission mechanism. Since return on

education is positive, the coefficient of the intergenerational elasticity of education φ_c in the first term is $\frac{\phi_c}{\phi_f} R^2_{Edf} > 0$, i.e. the intergenerational elasticity of education has a positive effect on the intergenerational elasticity of earnings (IGE).

Next, this paper decomposes the intergenerational income elasticity in China from 1989 to 2015 based on equation (9) for an in-depth analysis of the trends of various mechanisms of the effect. Before this period, we estimated the intergenerational elasticity of education and returns on education for the father and the child from 1989 to 2015 based on CHNS samples of 1989-2015 and equations (6)-(8), with results shown in Table 7.

Regression results in Table 7 indicate a rising intergenerational elasticity of education for Chinese households from 1989 to 2015, which doubled from 0.26 in 1989 to 0.48 in 2015, i.e. the intergenerational education mobility kept on the decrease in China. Children's return on education increased at first before decreasing, peaking at 0.153 in 2004 (see Figure 5). From 1989 to 2011, fathers' return on education also increased at first before decreasing, peaking at 0.15 in 2004 (see Figure 5). From 1989 to 2011, fathers' return on education increased before decreasing, peaking at 0.137 in 2006. In 2015, fathers' return on education started to increase, up about 0.05 from 2011. With the exception of 2015, fathers' return on education has been smaller compared with children's return on education.

On such a basis, this paper has decomposed the IGE calculated with equation (5) for 1989-2015 into three items with results in Table 8.

According to the decomposition results in Table 8, the first and second mechanisms, i.e. education have a limited impact on intergenerational income mobility in terms of absolute and relative proportions; under the third mechanism, father's non-education factors have a significant impact on children's income, i.e. a father's income or social status has the biggest impact on intergenerational income mobility by providing his children with a better living environment, better education and better job opportunities.

Table 7: Intergenerational Elasticity of Education and Father's and Child's Returns on Education, 1989-2015

	Child's education									
	1989	1991	1993	1997	2000	2004	2006	2009	2011	2015
Father's education	0.258 ***	0.297 ***	0.234 ***	0.292 ***	0.293 ***	0.373 ***	0.408 ***	0.378 ***	0.420 ***	0.478 ***
	-0.042	-0.035	-0.037	-0.038	-0.038	0.043	-0.041	-0.047	-0.044	-0.047
	Logarithm of child's income									
	1989	1991	1993	1997	2000	2004	2006	2009	2011	2015
Child's education	0.258	0.068 ***	0.080 ***	0.100 ***	0.105 ***	0.153 ***	0.131 ***	0.112 ***	0.086 ***	0.070 ***
	0.018	-0.015	-0.023	-0.017	-0.016	0.023	-0.019	-0.02	-0.017	-0.02
	Logarithm of father's income									
	1989	1991	1993	1997	2000	2004	2006	2009	2011	2015
Father's education	0.044 ***	0.064 ***	0.083 ***	0.090 ***	0.077 ***	0.101 ***	0.137 ***	0.083 ***	0.058 ***	0.1090 ***
	0.012	-0.009	-0.011	-0.016	-0.014	0.022	-0.021	-0.018	-0.013	-0.024

Notes: In the interest of length, Table 7 only shows three sections. Section 1 displays the regression estimation results of the intergenerational elasticity of education φ_c in equation (6) from 1989 to 2015; Sections 2 and 3 estimated regression results of the father's and child's returns on education ϕ_f and ϕ_c in equations (7) and (8) from 1989 to 2015.

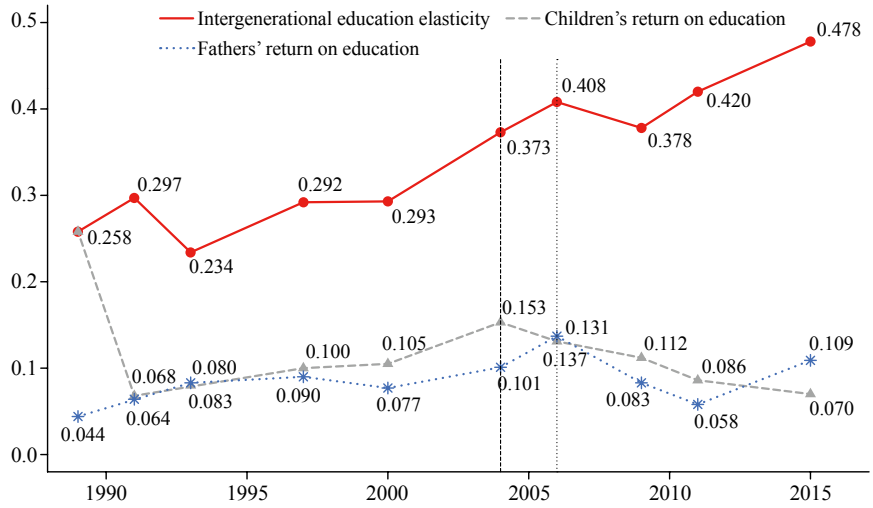

Figure 5: Fathers' and Children's Return on Education and Change in Intergenerational Education Elasticity, 1989-2015

Table 8: Decomposition of the IGE, 1989-2015

Year	Estimated value of IGE β_1	Mechanism 1		Mechanism 2		Mechanism 3	
		Value	Percentage	Value	Percentage	Value	Percentage
1989	0.2910	0.0074	2.53%	0.0075	2.59%	0.2761	94.88%
1991	0.4025	0.0315	7.83%	0.0241	5.98%	0.3469	86.19%
1993	0.4312	0.0225	5.22%	0.0203	4.71%	0.3884	90.07%
1997	0.3674	0.0273	7.44%	0.0208	5.66%	0.3193	86.90%
2000	0.3718	0.0269	7.24%	0.0020	0.54%	0.3428	92.22%
2004	0.4023	0.0349	8.68%	0.0207	5.14%	0.3467	86.18%
2006	0.2990	0.0713	23.83%	0.0206	6.90%	0.2065	69.27%
2009	0.3156	0.0789	25.00%	0.0208	6.59%	0.2159	68.41%
2011	0.3108	0.0277	8.90%	0.0094	3.03%	0.2738	88.07%
2015	0.2717	0.0127	4.66%	-0.0017	-0.63%	0.2608	95.97%

Judging by their changing proportions, the first three mechanisms accounted for relatively stable shares before 2004 and from 2004 to 2011; however, the first and third mechanisms have experienced significant volatility. Among them, the impact of education of IGE (Mechanism 1) increased at first before decreasing, peaking in 2009, and accounting for 25% of the IGE. This trend can be ascribed to the increasing intergenerational elasticity of education during this period and the fathers' return on education was significantly below the children's return on education. The increasing absolute value and proportion of the first transmission mechanism suggest that the education's transmission mechanism had weakened intergenerational income mobility during this period.

Around 2004, the effect of the college enrolment expansion policy started to appear with short- and long-term effects on intergenerational income mobility. In the short run (2004-2009), college enrolment expansion primarily impeded intergenerational income mobility, i.e. college enrolment expansion had

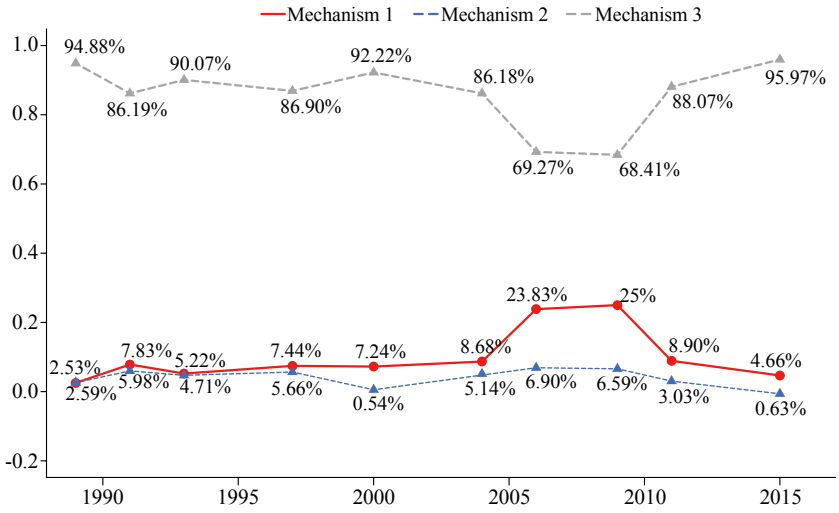

Figure 6: Education's Effects on Intergenerational Income Mobility, 1989-2015

reduced intergenerational education mobility, causing intergenerational income mobility to decrease. The uneven distribution of educational resources allows elite families with well-educated parents to invest in their children's human capital with economic and social resources at their disposal; therefore, enhancing their self-interest and giving rise to educational imbalances (Wang *et al*., 2019); the adverse effects on intergenerational income mobility thus took hold. From a longer timeframe (after 2009), college education enrollment's adverse income mobility effect started to diminish. While raising government spending on education, the college enrolment policy had eased the credit constraint of some low-income households for investing in their children's human capital and facilitating intergenerational income mobility to some extent.

Opposite to the first mechanism, the share of the fathers' non-education factors in the IGE (third mechanism) decreased first before increasing from 2004 to 2011. Judging by the absolute value, the impact of non-education factors has stayed below 0.3 after 2004, i.e. non-education factors have a relatively small and stable impact on intergenerational income mobility after 2004. As shown in Figure 6, the proportions of various mechanisms were relatively stable in and prior to 2004; however, they started to change after that.

6. Conclusions and Policy Implications

Based on 10 rounds of CHNS data from 1989 to 2015, this paper has employed two types of indicators and estimation methods to estimate changes in China's intergenerational income mobility and investigated the change in the intergenerational income mobility based on an income grouping perspective. On such a basis, the human capital analysis framework is utilized to decompose the IGE for further analysis of the intergenerational income transmission mechanism, which has led to the following conclusions:

First, the intergenerational income mobility in China kept relatively stable from 1991 to 2004 but started to increase after 2004. Second, after dividing the samples of various years into five equal groups by income level, we found the intergenerational income immobility to be smaller after 2004 for various income groups; however, high- and low-income groups were far more immobile than other groups. The middle-income group served as the key driver of intergenerational income mobility in China. Third, a decomposition of IGE in various years based on the human capital analysis framework found that fathers' non-education factors played a dominant role in intergenerational income transmission.

Our research conclusions point to the importance of taking a swathe of policy initiatives to increase the intergenerational household income mobility in China. First, attention should be given to the balanced development of education, especially vulnerable children in poor rural areas. Second, reasonable measures should be taken to increase the proportion of the middle-income group. Lastly, the household registration system should be further reformed to facilitate the flow of rural migrants.

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